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REPORT OF OBSERVATIONS

OF

INJURIOUS INSECTS

AND

COMMON FARM PESTS

DURING THE YEAR 1885,

WITH METHODS OF

PREVENTION AND REMEDY.

NINTH REPORT.

BY

ELEANOR A. ORMEROD, F.R. MET. Soc., &c.,

CONSULTING ENTOMOLOGIST OF THE ROYAL AGRICULTURAL SOCIETY; HON. AND CORR. MEM.
OF ROYAL AG. AND HORT. SOC., S. AUSTRALIA; CORR. MEM. OF ALBANY INSTITUTE, U.S.A., &c.

LONDON:
SIMPKIN, MARSHALL & CO., STATIONERS' HALL COURT.

1886.

Price Eighteenpence.

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LONDON :
PRINTED BY WEST, NEWMAN AND CO.,
HATTON GARDEN, E.C.

P R E F A C E.

IN once again submitting my Annual Report, I have, as in previous years, to offer my hearty thanks, both to the many friends who have kindly aided me by their communications, and also to the Agricultural Press for the great assistance that their support gives to the subject of prevention of farm insects, and the encouragement which the courteous assistance they grant gives to myself in the work.

The chief features of the insect attacks of the past season have been the great amount of Aphides or Plant Lice, which swarmed on most crops in consequence of the long drought being favourable to their increase. Surface-caterpillars also were unusually destructive throughout the autumn, and but for the snow, which in melting brings wet alternately with frost to bear on them (a state of things especially destructive to them), a further visitation was to be expected this spring. Some kinds of injurious crop insects, not previously noticed in these Reports, have been brought forward, and amongst various notes of habits, means of prevention, &c., which have been reported, I wish particularly to draw attention to the observation at p. 21 on absence of injury from Daddy Longlegs grubs where the land was thoroughly trampled by cattle. The observations of each year show more and more the importance of autumn measures to destroy, in embryo, the pests that, if left alone, raise (as a regularly recurring loss and trouble) the various attacks which devastate crops sown after broken-up pasture.

The Warble investigation, it will be seen, has much advanced. I am greatly obliged by the widespread assistance which has been afforded me in this important matter, and which I have more fully acknowledged in the special paper on the subject; but I should also notice that a very satisfactory amount of practical and serviceable knowledge of how to deal with this attack, as well as of mere scientific detail, was shown in the

competitive Prize Essays on Warblé, sent in by students (past and present) of the Agricultural School, Aspatria; I have to offer my thanks to the Principal, Mr. W. C. Taylor, for his co-operation.

During the last year attention to the subject of prevention of farm insect-pests has been steadily gaining ground, and much increased means of information placed at general disposal.

The Reports on Injurious Insects now being prepared for the Department of Agriculture by Mr. Whitehead, give short, clear accounts of the history and habits of our commonest crop-pests, so plainly worded that every one can understand them, and, from the mass of sound and clear information they contain, are to be thoroughly recommended both for study and distribution.* The good figures given add much to their value.

The benefit of giving plain instruction on these subjects in schools in agricultural districts is shown by the useful knowledge gained by the boys at Aldersey Grammar School, Bunbury, Cheshire, under the careful teaching of the Head Master, Mr. W. Bailey. Without taking them off the regular studies, and to the satisfaction of their fathers, the amount of plain *useful* knowledge gained has been so great as to elicit enquiry from the Consulting Entomologist of the Department of Agriculture, Canada, for service in the Dominion.

The re-arrangement of the cases of insects injurious to crops, fruit, and timber, belonging to South Kensington Museum, which is now in progress, promises to be of practical service. The insects exhibited are for the most part those which are serious in their ravages, and, as far as is possible, they are shown in their various stages (either by specimens, drawings, or models), with samples of injury caused by them accompanying.

The plan now followed of placing the various kinds of insects which attack any individual crop (or kind of fruit, &c.), together with the name of the crop or fruit in plain letters at the top of each case, removes all difficulty as to reference. An enquirer has only to look for the word "Apple," "Cabbage," "Oak," or whatever it may be, at the top of the case, and then may see,

* No. I. 'Reports on Insects Injurious to Hop Plants.' Price Twopence. No. II. 'Report on Insects Injurious to Corn, Grass, Pea, Bean, and Clover Crops.' Price 4½d. Sold by Messrs. Hansard, Great Queen Street, London, W.C.; Messrs. Eyre and Spottiswoode, East Harding Street, London, E.C.; Messrs. Adam and Charles Black, Edinburgh; and Messrs. Alexander Thom and Co., Dublin.

or rather will be able to see, when the cases are duly placed, the common kinds of attacks, and, if he has brought a specimen with him, to name it by comparison. A portion of this work is being carried on by Prof. Westwood, which, it is unnecessary to say, is beautifully executed, and a part by Mr. S. L. Mosley, of Huddersfield, which is excellent both in clearness of arrangement and beauty of the drawings, some of which are by his own pencil, some by that of the late Mr. Andrew Murray.

In regard to the illustrations of my present Report, I again offer my thanks to Messrs. Blackie and Son, Glasgow, for the use of electros from the figures by John Curtis, published in 'Farm Insects,' to which I have this year been able to add about twenty-two figures, mostly drawn from my own specimens, and in other cases with the source duly acknowledged.

The figures of the Moths, namely, Small Swift, Antler, Magpie, Common Vapourer, and Puss Moths, are taken, by permission of Messrs. W. H. Allen and Co., from Newman's 'British Moths.'

Altogether the advance of the branch of agricultural service dealing with the prevention of ravage of farm insects has been very satisfactory; and in the special point of reporting on injurious kinds of insects, whilst new information of a useful nature has been sent in during the last season regarding several of our crop-pests, this has been notably the case regarding Warble-attack. I trust that my correspondents will again allow me to remind them that I have always pleasure in attending, to the very best of my power, to all enquiries bearing on prevention of insect-ravage, and shall hope in due season once again to submit a Report to their acceptance.

ELEANOR A. ORMEROD.

DUNSTER LODGE, NEAR ISLEWORTH,
March, 1886.

NOTES OF OBSERVATIONS
OF
INJURIOUS INSECTS
AND
COMMON CROP PESTS
DURING 1885.

BEANS.

Bean Aphis. *Aphis rumicis*, Linn. ; *A. fabæ*, Kirby and Spence.



APHIS RUMICIS.

1, Bean-shoot, with Aphides ; 2, male Aphis, mag. ; 3, nat. size ; 4, wingless female, magnified.

One of the most injurious and widespread of the crop attacks of 1885 has been that of Aphides or “Plant Lice,” commonly known as “Green Fly,” “White Lice,” “Black Fly or Colliers,” or, by way of general appellation, as “Smother Fly” ; and Beans, in common with various other field crops, suffered severely in various localities.

In the following notes observations are given of the short time elapsing between the first appearance of the “Colliers” and attack being established on infested plants ; of the long drought accompanying attack in one of the badly-infested districts ; of the effects of various

applications on the growth of the Beans, and of the good effect of cutting off the infested tops; likewise some amount of estimate of loss.

Fear was entertained, both in England and Ireland, that the "Collier," or Bean Aphis, had spread to the Mangolds, but, as far as such specimens of infested Mangold leaves as were forwarded to myself showed, these Mangold Aphides, though very like the "Colliers" in appearance, were of a distinctly different kind.

The true Bean Aphis, commonly known as "Collier," is the *Aphis rumicis* of Linnæus, and, according to the description given in Buckton's

'British Aphides,' both the winged and wingless females, which produce the living young so soon overspreading our Bean plants, are black. The young, as far as described, are of a slaty grey, gaining their black velvety coats as they increase in age; and the pupæ—that is, the insects in the stage with wing-cases, but not yet with wings—have the head and fore body of a slaty grey, and the abdomen black, with various white spots, "which give the insect a kind of chess-board or chequered appearance." *

Varieties of this species are to be found on other plants, and another species, which is with difficulty distinguishable from the true "Collier," and which frequents another plant as its home, is sometimes to be found on the Bean. The subject therefore is one of difficulty. For further observations see "Mangold Aphis."

In regard to the rapid spread of the Aphides on infested plants, Mr. S. L. Mosley, writing from Beaumont Park, Huddersfield, gives the following note:—"Bean Aphis extremely abundant this season, and must have done a large amount of damage, as gardeners here take little note of them *until the plants are exhausted*. I planted a row of Beans and allowed the "Colliers" to have their own way, as I wished to watch them; they almost covered the plants within a *fortnight* of their first appearance, and, though the plants produced one or two fine pods, the majority were shrivelled and worthless.

"Before I have always found topping the plants when the insects first appear to be the best remedy."

Mr. Edm. J. Gaskell, of Prenton Hall Farm, Birkenhead, (Sec. of the Wirrall Farmers' Club), forwarded the following communication regarding Aphis-attack:—"Beans, too, have been very much blighted; they were covered with a kind of honey, and with green flies, which caused the tops to go black and fall down, stopped the growth, and made all pods on the plants to become soft. We had twenty-four acres which were very bad. I made an examination the first week in August, and came to the conclusion that if I left them to ripen there

* (See Buckton's 'British Aphides,' vol. ii., pp. 81—83).

would be very little corn,—scarcely worth threshing,—and all the sap (and leaves) would have left the stem. So I thought it best to cut them at once and make them into hay, which I did, and I think I have secured some very good horse provender, which I intend having chopped during the winter. I will also try the milking cows, and see if it will produce milk.

“There was not a Sparrow to be seen in the Beans.”

Mr. Ralph Lowe, of Sleaford, Lincolnshire, reported, on August 10th:—“We have suffered greatly in Beans and Peas from the ravages of the Aphis. Fields that promised two quarters to the acre are reduced to one quarter. The air has for days been full of the winged green Aphis.”

The Rev. T. H. White, writing from the Vicarage, Weybread, a locality lying just at the northern border of Suffolk, reported that—“Peas (field) were generally a failure; the bulk promised great things, but the drought was too much for them, and the myriads of Green Fly sucked all the goodness out of them.

“Spring Beans failed, owing to the Fly and the drought, but Winter Beans were a capital crop.”

On Aug. 12th a portion of Bean-stalk covered with Aphides (locally known as “Smother Flies”), many of which were grown over with mould, was forwarded to me by Lady Knightley, from Fawsley, Daventry, as an example of the attack which was then doing great harm to the Bean crops.

The following note by Mr. Thomas H. Hart, of Park Farm, Kingsnorth, Ashford, Kent, an excellently qualified observer, confirms the views given in previous seasons of cold winds, drought, or circumstances which tend to cause either stunted growth or unhealthy flow of sap, being favourable to multiplication of plant-lice:—

“Black Dolphin, Collier.—A general and terrible pest in spring-sown Beans. It was first noticed just after the Beans began flower, and rapidly spread over the fields. The cold winds in the first place, and the want of rain in the second, prevented hoeing and cultivating having any beneficial effect. The blossoms dropped off, the leaves yellowed and finally shrivelled up and dropped, and the plant ripened prematurely. I cannot recollect any attack of this pest so generally disastrous as this year. Acres upon acres will barely pay the cost, to say nothing of other expenses. I sowed five acres, and I may get five quarters of Beans from it; but a neighbour, who had about ten acres, was advised by a friend to plough them up with a broadshare, harrow off, and carry into the yards, it being thought that the first sacrifice would be the least.”

Mr. Hart further noted, on Sept. 9th:—“The drought came to an end on Monday, having lasted just twelve weeks. I registered 1·09 in

June (0·87 falling in the first eight days), 0·21 in July, and 0·30 in August; the total rainfall for twelve weeks ending Sept. 6th, being but 1·15 inches."

[In my own garden at Dunster Lodge, near Isleworth, the Beans did remarkably well. The rainfall was not notably below the average, excepting in July, when it only amounted to 0·47 in.—that is, less than half an inch fall for the month; but also the Beans were grown on ground that had been dressed with gas-lime in the previous winter. The gas-lime had lain exposed for many months, and was applied at a rate which might be roughly estimated as somewhat under two tons to the acre.—ED.]

The following observations of Mr. John W. Crompton, of Rivington, Chorley, Lancashire, refer especially to condition of Bean-ground on land treated with "alkali waste," a waste product thrown out in great quantity from alkali works, and nearly allied in chemical composition to gas-lime, both one and the other being, when exposed to air for some weeks, very similar in their effects to gypsum.

The following observations are by Mr. Crompton, to which I append a footnote regarding the use of gas-lime, as enquiry is often made on the subject. Mr. Crompton observed:—

"The Beans this year followed Oats, part of the field had been dressed with alkali waste two or three years ago, and all of it had been dressed with it in the autumn and winter months of 1884-5. It also had a spring dressing of gypsum and tobacco-ash, and one or two loads of ash-pit manure were spread at one part of the field which had been dressed with 'waste' [alkali waste, ED.] three years ago."

The experiment in Bean-culture resulted as follows:—

"The old and abundant application of alkali yielded a most vigorous and healthy crop; where the ash-pit manure was put yielded a heavier growth of straw, but I do not think was better for it in Beans; the part of the field only recently 'alkali-wasted' did badly, and I cut the Beans for green fodder.

"The Aphis attacked the whole field, and destroyed the weak Beans; the strong Beans were topped, and the Aphis did little damage to them; only an odd stem here and there was destroyed by them.

"Some garden Beans in this neighbourhood were utterly destroyed by Aphis, although topped.

"I find it best to apply alkali waste on stubbles as soon as the corn is off the ground, and the best crop to follow seems to be the Potato; this is on heavy soil. After Potatoes, any grain or Beans.

"It is a great pity that the alkali waste is not more widely distributed over the country and accessible to farmers. I apply 'waste' to my manure-heaps occasionally, and it seems to answer very well, causing them to rot, and also *destroying insect-life*."

The great serviceableness of gas-lime in destroying insect-eggs or vermin at the surface of the ground is well known, and, with regard to the beneficial action in the case of Beans and similar crops, the following extract, taken from the pamphlet 'On the composition and use of Gas-lime in Agriculture,' by the late Dr. Aug. Voelcker, Consulting Chemist of the Royal Agricultural Society, will be of interest:—

“Gas-lime not only supplies lime to plants, but also sulphuric acid, a combination not present in any quantity in quicklime. For leguminous crops, such as Peas or Beans, for Clover and other crops specially benefited by sulphate of lime or gypsum, gas-lime, when obtainable, as is generally the case at a trifling expense, is certainly preferable to quicklime as manure.”

It is further remarked:—“The crops which are particularly benefited by gas-lime, are Clover, Sainfoin, Lucerne, Peas, Beans, Vetches, and Turnips.”

These remarks, particularly if taken in connection with the observations of Mr. Buckton in 'British Aphides,' regarding production of Aphides being most rapid where from some of various causes the flow of sap is not in a soundly healthy state, greatly confirms Mr. Crompton's view of the alkali waste (which is very similar in composition to gas-lime) being very serviceable in helping his Beans through the Aphis-attack.*

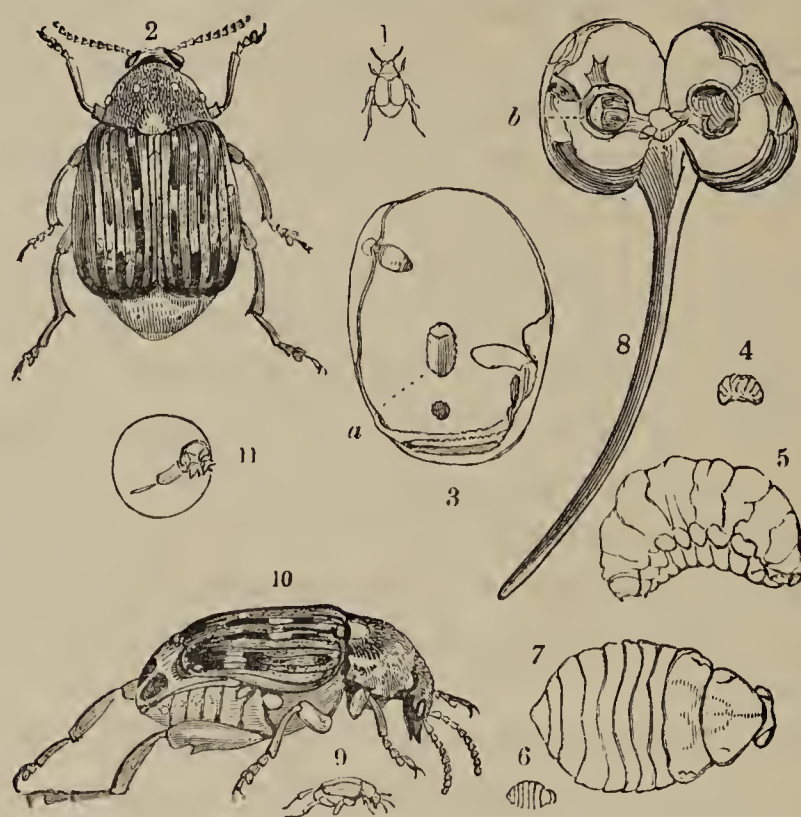
The above notes show presence of Bean Aphis as a bad attack at localities in Lincolnshire, Yorks, Lancashire, Cheshire, Worcestershire, and Kent, with reduction of yield sometimes merely mentioned as serious, sometimes as reduction to one quarter per acre, where the crop would have rightly yielded two, and sometimes a failure, necessitating cutting the crop for hay or fodder.

As yet no better method of checking the attack is known than cutting off the tops of the Beans as soon as ever the first appearance of "Colliers" is seen, and where this is done, and the plants are in good heart, the plan appears to succeed well.

* The difficulty in the use of gas-lime is, how much to apply, and also how long before the succeeding crop is put in the gas-lime may be laid on the land, as the utterly destructive properties which make gas-lime or alkali waste valuable to clear both insect, and plant vermin, when they are applied in caustic state fresh from the works, must be neutralised by exposure to air to cause the changes which turn the one or the other to a manure safe and serviceable in all cases where gypsum would be of use. Some observations as to quantities found serviceable have been given in preceding Reports, but the matter in its strictly agricultural and chemical bearing not falling fully within my own personal knowledge, I give the following extract from Dr. A. Voelcker's pamphlet above referred to:—

“With regard to the quantity of gas-lime that ought to be put on the land, no general rule can be laid down, for the quantity should be regulated by the relative

Bean Beetle ; Seed Beetle. *Bruchus granarius*, Linn.



BRUCHUS GRANARIUS.

1 and 2, *Bruchus granarius*, nat. size and magnified ; 3, infested Bean ; 4 and 5, maggots ; 6 and 7, pupæ, nat. size and magnified ; 8, Bean injured by beetle, vegetating ; 9 and 10, *Bruchus pisi*, nat. size and magnified ; 11, injured Pea.

The *Bruchi* are small, thick-made beetles, rarely above the sixth of an inch long, which feed in the maggot-state inside the seeds of Beans, Peas, and other leguminous plants, and thus do damage both by wasting the material of the seed and also by weakening the young plant, which is thus robbed of the food which would have given it a good start at the time of germination or first sprouting. The injury is, of course, of more or less importance, according to the amount of the cotyledons, or future “seed-leaves,” which are eaten away.

The following inquiry regards some points of interest in the history of the Bean *Bruchus* :—

“Having just received some Beans (of which the enclosed are a sample), I am anxious to know if the insect which infests them—which, I am told, is the ‘Bean Weevil’—is injurious to the germ,

deficiency in calcareous constituents which different soils exhibit. Speaking generally, however, two tons may be used with safety, and in many instances a heavier dressing will not be amiss.

“The proper time for application is autumn, or during the winter months, when vegetation is at a standstill.

“On arable land gas-lime should be applied to the stubble *spread out evenly*, and left exposed to the air before ploughing up for three or four weeks. On grass-land it should be spread during the months of December or January, or at any rate before vegetation is making a fresh start.”—‘On the composition and use of Gas-lime in Agriculture,’ by Dr. Aug. Voelcker, p. 4.

and if so, how far? When I wrote in question, I was informed that this insect in no way impaired the vitality of the germ; that it was, in fact, harmless, and did not reproduce itself in this climate; and, further, that contact with the cold earth soon destroyed it.

“Also that it was impossible to obtain Beans without a percentage of these insects, as the crop was harvested in the South of Spain, and during growth they introduced themselves into the pod.”

In regard to the manner in which the maggot is introduced into the seed, the following appears to be the method of attack:—The beetles lay their eggs on the ovary of the blossom, or the pod in its youngest state, and from these eggs the maggot hatches, and eats its way into the seed. There the grub feeds and turns to chrysalis, and appears generally to pass the winter in this state, and to change to the beetle in the spring. Then it pushes out a round bit of the skin of the Bean, which has covered the entrance of its gallery, and comes out to start new attack.

The common *Bruchus granarius*, which infests both Beans and Peas, is a common insect in this country, and we have direct evidence from experiment of John Curtis (see ‘Farm Insects,’ p. 360) that *Bruchi* were found by him on Beans which he had raised from foreign seed. He also mentions this “Seed Beetle” as a most destructive insect in Pea and Bean fields.

With reference to the amount of injury caused to the germ? The attack occasionally has been found to spread to this part, but the germ itself has been observed to be very seldom injured. The chief damage, as far as growth is concerned, is caused by the grub galleries removing a part of the substance of the seed, and the young plant being weakened by the absence of the full supply of nourishment which it should have received at the beginning of its growth.

Autumn-sown Beans are more liable to be attacked than those which are spring-sown, because commonly the greater part of the beetles do not leave the Beans till the spring. Infested Beans may be known by having a little round depressed spot, as if the skin had been pressed down by the end of a knitting-pin. If this is noticeable on many Beans the sample may be considered to be still badly infested; if instead there is a small hole, the beetle has gone, and the seed will therefore not contain anything to continue attack, but will be the worse by the amount eaten.

As far as we know at present, the only security of the ordinary buyer lies in carefully examining a sample of the seed. When once he has seen the small horny-looking depressed spot on the skin of the Bean he will know it well in future, and be able to judge as to the state of his proposed purchase. With regard to importers, their best defence is that which I know to be used by one of our leading seed

suppliers, that of eschewing purchase of seed from countries known to be much infested. As to the next step backwards up to the fountain-head of the mischief—how to prevent attack—one point is not to use infested seed, and—and this most especially—in Bean seed-growing districts, to change the crop frequently, or for the growers, by agreement, to sow no Beans or Peas for one season in an infested district. If this regulation could be established, as was proposed a few years ago in Canada, where the Pea *Bruchus* is a serious cause of loss to growers, it would make an immediate difference in the condition of our imported supplies.

Various methods of destroying the *Bruchus* in the seed have been suggested, as dipping it in oil, in water just hot enough to kill the “Seed Beetle” but not the seed; likewise putting infested seed in water has been advised as a means of dividing the injured and uninjured, by floating. But all these plans seem of very doubtful, or less than doubtful, utility; and, without entering on the different kinds of *Bruchi* or “Seed Beetles” which infest crops in England, it may be safely stated that the great security is for the buyer to see that his sample is not infested, and for the importer to avoid infested districts.

“Small” or “Garden” Swift Moth. *Hepialus lupulinus*, Linn.



HEPIALUS LUPULINUS.

Moth, caterpillar, and chrysalis.

During the last few years specimens have been occasionally sent of a caterpillar which resembled the “Surface-caterpillars” in manner of feeding, but was much smaller, and white or of a yellowish tint.

Early in the spring of the present year a further supply of specimens were sent me, which were then doing damage to winter Beans, and which agreed well with the descriptions of the caterpillars of the “Small” or “Garden” Swift Moth, *Hepialus lupulinus*. As the attacks of this caterpillar have not been brought forward amongst regular crop-pests before—and there appears reason to think that a

good deal of mischief, of which the precise authorship has not been traced, may be owing to these caterpillars working on various kinds of plants just below the surface in the spring time—I append the full description;* as given by John Curtis in his paper on this subject in the ‘Gardeners’ Chronicle’ for 1845, p. 873.

The figures of the caterpillar and chrysalis are partially taken from those given by Curtis in the paper quoted, and it will be observed that the chrysalis shows the shape of the forming moth within it, and that the position of the wings and legs are clearly discernible.

The figure of the moth gives an idea of its size and shape, but the colour is excessively variable. It may be generally described as having the fore wings clay-colour or brown, with various white stripes and dots, but sometimes the ground colour is very pale, sometimes there are no markings; and, as the names differ as much as the varieties, I have taken Professor Westwood’s name of the “Small Swift,” which distinguishes it well from the much larger kind (the “Ghost Moth” or “Hop Swift”), the caterpillar of which specially attacks Hop-roots. The name of “Swift” is given on account of the rapidity of the flight. The moths may be seen in the evening by hedgerows or grassy banks, over grass, where they drop their eggs in large numbers.

The caterpillars which hatch from these are recorded as living on the roots of a large variety of plants, amongst garden crops, on Parsnip, Lettuce, Potato, Celery, and Strawberry plants, also on grass-roots; and, with regard to their powers, it is mentioned, “their destructive habits are scarcely to be equalled by the ‘Surface-grubs.’” The caterpillars are to be found in autumn and winter, as well as spring, and are stated to turn to chrysalids in May, from which the moths come out in about a month.

The following notes refer to an attack on Beans at Elsenham, Bishop’s Stortford, with which I was favoured by Mr. Martin Burt; part of this information first appeared in the ‘Agricultural Gazette,’ of March 9th, p. 305, as follows:—The observer “sends us two specimens of earth-grub which are destroying his winter Beans, gnawing the stalks in two a little below the ground. They were a strong healthy plant, sown early in October, ploughed in and pressed with ribbed roller in strong clay-land after wheat.” “He is afraid some two acres of the twenty are past redemption.”

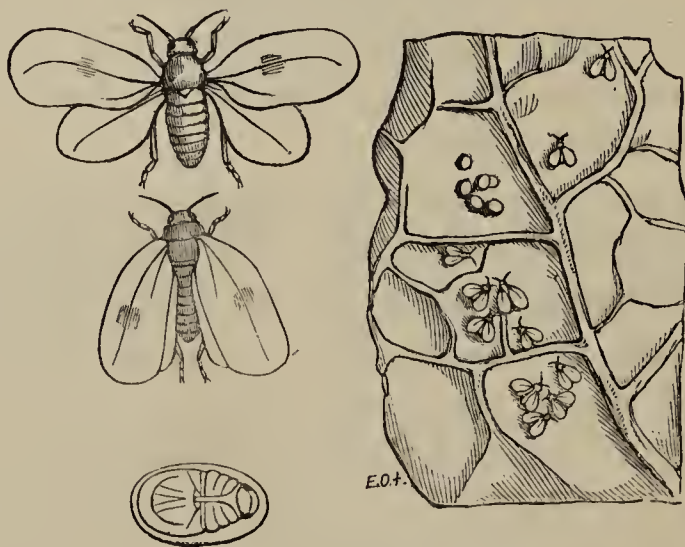
* “The caterpillars are cylindrical, yellowish white, the head is brown and horny, with two minute antennæ; the 1st thoracic segment is horny and pale brown; the following segments have [four dark dots on the back of each, producing bristles, with a greyish intestinal line between them often blackish at the tail; there is a similar line of dots and hairs down each side, and beneath them the black spiracles, which are bristly. They have six pectoral, eight abdominal, and two anal feet. They changed to a very sensitive, cylindrical pupa, ochreous and shining.” —‘Gardeners’ Chronicle’ for 1845, p. 873.

On the 10th of March Mr. Martin Burt let me have some further supply of specimens, with the remark, "In digging them out this morning, being frosty, I find some of them retired quite into the solid ground, in a cavity just fitting them." A few days later, Mr. Burt added, "To-morrow I am going to cultivate as deeply as possible between the rows of Beans, in hopes of turning out a good many of the pests and destroying their runs." This plan might be expected to act well, for the grubs were obviously sensible to weather influences, and turning them out of their nests would act as strongly on them as on the "Surface-caterpillars," which are best got rid of by throwing them up in cold and wet. All measures of treatment suitable for clearing "Surface-caterpillars" (see paper on this pest) would be applicable to these grubs also.

Further information as to attack by this grub would be very useful. Its smaller size and white tint distinguish it from the common "Surface-caterpillar."

CABBAGE.

Snowy Fly ; Cabbage Powdered-wing. *Aleyrodes proletella*,
Linn. ; *A. cheledonii*, Latr.



ALEYRODES PROLETELLA.

Fly and pupa, much magnified. Flies on leaf, twice nat. size.

On the 21st of March a piece of Broccoli leaf was forwarded to me from Hoe Court, Colwall, Malvern, by Miss Raper, which had been brought in that morning, covered with the small insect sometimes known as "Snowy Fly," or, from its likeness to a very minute moth, as "Moth-blight." It was mentioned that the whole crop was spoiled by it, likewise that it had not been observed before.

The *Aleyrodes*, or "Snowy Flies," are nearly allied to the Aphides and Scale insects, and, like them, injure the plants they attack by piercing into them with their suckers and drawing away the juices. The common "Cabbage Snowy Fly" (figured above) lays its eggs in patches, and the young, which hatch in somewhat less than a fortnight, spread themselves over the leaves, and there feed (looking like minute white or yellowish Scale insects) for about ten days; they then turn to chrysalids on the skin of the leaf, from which the little four-winged flies come out in about four days more. This is the sequence given by John Curtis of their summer life, but the insects live and multiply throughout the year. I have seen them in great numbers on Cabbage plants in W. Gloucestershire, and they occasionally appear as a regular pest, as in 1846, when "the whole of the Broccoli and Cabbages in the neighbourhood of Romford, Essex," were reported to be infested by millions of *Aleyrodes* in the fly-state.

The attack, when bad, ruins much of the leafage, which turns brown or yellow, and falls off; and there is the unusual inconvenience that the creatures are to be found doing mischief all the year through. They have been observed to withstand rain and cold, and have been found in all stages in the middle of the winter.

There is no difficulty in recognising this attack, first by the little white or brownish scale-like grubs; next by the singular appearance of the little flies which rise on the plants being disturbed, as I have seen them when a dog has run amongst the Cabbages, as if a shower of small snowflakes was dispersed through the air, the "Snowy Flies" immediately settling down again.

As the attack is mainly beneath the foliage, there is great difficulty in bringing any kind of dressing to bear on the insects; and the best treatment appears to be cutting off the infested Cabbage leaves and destroying them. This should be thoroughly done, and at once, as, if the leaves are only thrown to a rubbish-heap, they will remain fresh enough for some days to support many of the grubs up to the stage in which they turn to the chrysalis. Throwing the leaves to be trampled in farm-manure gets rid of them thoroughly, or burning amongst rubbish would answer better.

The "Snowy Flies" shelter in any convenient nooks on the surface of the ground, or under leaves; therefore, digging infested ground or top-dressing with caustic lime would be of service.

CORN AND GRASS.

Antler Moth, or Grass Moth. *Charæas graminis*, Stephens ;
Cerapteryx graminis, Curtis.



CHARÆAS GRAMINIS.

Antler Moth and caterpillars.

The attacks of the caterpillars of the Antler Moth are remarkable for only occurring occasionally, and especially in mountainous districts, and for these appearances being in such vast numbers, and over such a large extent of country, as to be an amazement to all not acquainted with their habits. Such an attack occurred in June of 1884 in the mountainous part of Glamorganshire, extending over an area of about ten miles of the country lying west of the Rhondda Valley, and such an attack occurred again in the past summer of 1885 in Selkirkshire, N.B., destroying in its course some of the hill-pastures in Ettrick and Yarrow.

One farmer, writing at the time from the infested district, stated :—
 “ They were very bad on my farm, there being a good number of acres where not a blade of grass is left. *They began first on the best land*, but are in the bogs (marshy ground) now.”

The extent of country was shown on a map forwarded at the time by a line enclosing an area of about seven miles by five miles, lying in the west of Selkirkshire, with Ettrick water running down the middle.

As the history of the insect was given last year, I merely repeat it now in a note ;* but the injury to good pasturage mentioned above is

* The above figure gives the size and method of marking of the Antler Moth and caterpillar. With regard to colour, the moths are variable, but may be generally described as having the fore wings of various tints of brown, with somewhat pale or white antler-shaped markings, from which the moth takes its name. The hind wings are brown or greyish brown. The caterpillars are marked with dark brown, and pale streaks running lengthwise: the head is brown or yellowish. The life-history is stated to be that the eggs are laid by the female moths about the middle of summer ; these hatch in about three weeks, and the caterpillars are then said to hide themselves by day and feed by night ; they live through the winter, and in spring again begin their destructive operations. These continue till about June, when they go down into the ground to turn to chrysalids, from which the moths come out to lay the eggs, as above mentioned, in July and August.

worth notice relatively to the opinion which has been occasionally brought forward that the damage done to pastures by the caterpillars may in some places be compensated by the increased production of grass in future seasons.

One of our leading agricultural authorities remarked relatively to this point:—"The worst of mountain pastures is that they never are fed down bare by the sheep and cattle which graze upon them, and the accumulation of rough grass is a fertile source of disease amongst the stock. If once fed down, by whatever means, the future growth of the grass will not only be sweeter and healthier, but the land will graze a far greater head of stock."

The above is very true as to the benefit of having the mountain pastures better grazed down, but, in regard to the caterpillars doing the work, I should say they are far too indiscriminating to prove a profitable kind of grazer.

No detailed reports have been forwarded as to the parts of the grass which were devoured by the caterpillars in either of the above attacks, beyond the general fact of the pasture being devoured; but, with regard to this important point, it is stated, in Curtis's 'Farm Insects,' pp. 506, 507, that "they live on the roots, and eat away all shoots." In 'Kollar on Insects injurious to Gardeners, Farmers,' &c., p. 137 (English translation), it is stated:—"The food of the caterpillar consists of all the soft sorts of grasses. It lives at the roots, and eats all the germs. Although it is in existence in autumn, it lies benumbed in the earth in winter, and begins to eat again in the spring; yet the effect of its devastations appear chiefly in the beginning of June, when it has changed its skin for the last time."

Kaltenbach (another good German authority) places the Antler Moth amongst the insects infesting Wheat and Rye, and, under the head of Barley, notes that the caterpillars live at the roots of various kinds of cereals, to which they are destructive; and Linnæus stated the Antler Moth caterpillars to be "the most destructive of Swedish caterpillars, laying waste our meadows, and annihilating our crops of hay."

It would be very serviceable to know whether the presence of better grass was found in 1884 to follow on the scenes of caterpillar-attack of 1883 in Glamorganshire, and also whether in either of the attacks mentioned above there were warnings of what was coming in an unusual number of moths being observed in the previous summer. At present there seems to be no reason to fear that the attacks of the caterpillars are increasing in frequency, and so long as they come without any previous presence of the moths being observed nothing can be done in the way of prevention. Still, when these vast legions do appear, it would seem desirable to check their devastations and

prevent them spreading on to useful pasturage or corn-land as far as possible. For this purpose firing bands or patches of the dry mountain growths is one plan; digging shallow ditches, in which the caterpillars are collected in great numbers when on the march and destroying them in these, is another. Pigs are stated to be exceedingly fond of them, and can be turned on to the ditches to devour the grubs. Also where trenches could be filled with water, or water diverted from mountain streams across their onward path, this would do good.

The usual class of remedies for grub-infested land, such as lime, salt, &c., have been, and doubtless would be, of use if the nature of the land allowed them to be applied at a paying rate early in the attack. But, when established, no remedies except such as are on a broad scale, as firing, or excavating trenches, or turning water on, appear to meet the widespread nature of the trouble.

Corn Aphis, Dolphin, or Plant Louse. *Aphis* (*Siphonophora*) *granaria*, Kirby; *Aphis avenæ*, Fab.?



APHIS GRANARIA.

1—4, winged and wingless Aphides, nat. size and magnified (3 and 4 discoloured from attack of parasite fly); 5 and 6, *Aphidius avenæ*; 7 and 8, *Ephedrus plagiator*, parasite flies, nat. size and magnified.

Attack of Corn Aphis has been unusually prevalent during the past season, and has been injurious to Oats as well as Wheat. Damage from Corn Aphides or Plant Lice has occasionally been reported in previous years, but not to the extent in which it appeared last season, and, as various inquirers sent regarding it as an attack which was

either new to themselves or not observed before over a large district, it may be presumed that a much larger amount of it was present than usual.

Attack was reported at various places extending from Fife in Scotland to Kent, but the observations were mostly across the northerly or north-midland part of England,—Cheshire to Lincolnshire,—and it is worth remarking that the inquiries mostly bore date from the last days of July to about the fourth week in August: that is to say, in fact, that (as far as inquirers or reports showed), the southern counties, in which the harvest is the earliest ready for reaping, was the least affected by the pest. On the 18th of August specimens were forwarded from Largo, Fife, to show the attack which had recently been doing much injury on the correspondent's farm; and on the same day, during a railway journey from London to Hastings, I noticed a large proportion of the corn-fields in sight from the line had the crop either cut or carried. This is of importance relatively to some points of prevention to be entered on further.

In regard to the kind of Aphis, or "Plant Louse," which caused the damage, some of those which were forwarded, and some of which notes were sent, appeared to be of the common Grain Aphis, the *Siphonophora granaria*, Buckton; but by far the larger proportion of the great numbers sent me were entirely brown throughout all their stages, and without any of the green in the early stage, or partial amount of green in the winged specimens, which is characteristic of the true *S. granaria*. They corresponded more with the *A. avenæ*, Fab., of which some short description is given in Curtis's 'Farm Insects,' p. 500, and leave the matter consequently in doubt whether this so-called "Oat Aphis" is not a true, distinct species, or whether these dark Aphides were a variety of the variable "Grain Aphis," or again (following the conjecture sometimes brought forward), whether there is a change of colour in the insect with the change of food,—from green whilst feeding on the leaves or stem, to the brown colour when it has settled in the grain. A large proportion of the specimens reached me alive and unparasitised, and it will be noticed from the following observations that the deep brown or blackish colour was so remarkable that this may be a guide next season to those unacquainted with the insect, making out its presence on their corn.

About the end of July, infested Wheat-ears were forwarded by Mr. G. W. Latham, of Bradwall Hall, Sandbach, Cheshire, with the observation that when he gathered them "they were *black* with Aphis, the appearance being as if the interstices had been filled up with 'smut.'" In this case the infested ears were principally sheltered by a high hedge and near trees, and none were found in the centre and bottom of the field, where instead of a hedge there was a wire fence.

On the 3rd of August Mr. Ashworth, writing from Tabley Grange, Knutsford, Cheshire, reported:—" *The whole of the Oats and Wheat of this district is attacked, and I fear the yield will be most seriously damaged. It is not unlike the 'Rose Fly,' but brown in colour. We have had a long continuance of dry weather, with cold east wind.*"*

Mr. E. J. Gaskell, Secretary of the Wirral Farmers' Club, Birkenhead, also in Cheshire, reported, on Sept. 10th:—" We have had a great quantity of black insects in Wheat, Oats, and Barley in the district (more than could possibly be eaten off by birds, the heads of Wheat being black with them), which has caused quantities of ears to shrivel and only yield very small corn, say 5 per cent. loss."

Wheat-ears infested by Corn Aphis were forwarded from near Knaresboro', Yorks, with the observation that most of the Wheat in that neighbourhood had been affected by the attack; and on August 17th Aphis-infested ears of Wheat were sent from Lumby, S. Milford, Yorks, by Mr. R. Gouthwaite, with the mention that the plant-lice had been first observed about a fortnight before, when some of the ears were "quite black with them," and that the ears sent were plucked at random from a field of Wheat infested by millions of the insects. It was further remarked, "I have seen them on the Wheat before, but it is years since."

About the same time (that is, August 10th), Mr. Ralph Lowe noted from Sleaford, Lincolnshire:—"The Wheat-heads are covered with what I have always considered to be Aphides, clustered upon many heads last evening."

Further north the attack was troublesome at the same time. Corn Aphides were forwarded by an agricultural correspondent in Edinburgh, as specimens of insects which were then proving very injurious to cereal crops; and on August 18th a correspondent at Largo, Fife, reported that one of his fields of Wheat had recently "had all the appearance of 'smut,' and very badly, too. On examining the heads the appearance resolved itself into thousands of small black insects tucked into the interstices of the still green heads." The note further added that a heavy shower which had occurred seemed to have destroyed them.

At two localities (respectively in Kent and Herefordshire) the attack appeared to be wholly or in part of the true Corn Aphis.

* The following is a short general description of specimens forwarded from Tabley Grange:—The youngest forms or "lice" were fawn or brown. The pupæ brown or chestnut-brown, with the fore body paler, and with a greenish tint; the wing-cases (which are at this stage appendages like little fins or flattened spikes laid on the sides), were pitchy-black down the middle; the honey-tubes pitchy. Winged specimens: Fore body chestnut or somewhat yellow-fawn; abdomen of a darker shade of chestnut, and eyes dark chestnut. Wings glassy, not quite transparent, with yellowish nerves.

On August 8th Mr. David Rowland, of the Balance Farm, Titley, remarked:—"I beg to call your attention to the enclosed ears of Wheat brought to me by a neighbouring farmer. The ears were nearly all deficient of three or four corns, at the base; and many of those higher up (especially the central corn) were empty. We found an insect, *sometimes green* and *sometimes nearly black*, in an inverted position, attached to the corn where it joins the stalk.

"It appeared as if the insect had sucked the juices out of the corn, and that the grain then withered up, leaving nothing but chaff. The effect will seriously affect the yield per acre."

In this case, and in one or possibly two others, there was some amount of presence of Corn Thrips and of Red Maggot along with that of the Plant Lice.

In the following remarks, contributed by Mr. T. H. Hart, late of Park Farm, Kingsnorth, Ashford, Kent, some notes are given of the gradual spread of the attack from the leafage to the forming ear, and it will be observed that in this case the large and small Aphides at the early stage of the attack were green, presumably therefore of the true Grain Aphis, *Siphonophora granaria*. Mr. Hart wrote as follows:—

"*Dolphin*.—Far too plentiful for the good of the crops, yet difficult to define what damage was done. Long before the ears were visible large specimens of Aphis surrounded by a brood of little ones were to be found on the upper surface of the ribbon of almost every plant, especially of Oats. These were green. Later on small 'lice' of a colour tending towards chocolate were scattered about the *under side* of the ribbon, and, still later, when the ears and panicles were well expanded, larger green Aphides clustered between the sets of Wheat or Barley and at the base of the grain of Oats."

Badly-infested Wheat-ears were also forwarded to me on the 31st of July from Holme, Biggleswade, by Mr. C. S. Lindall, with the observation that every ear in one part of the field from which the sample was taken was infested, and that on this part the crop seemed likely to be entirely destroyed. Nothing wrong was detected on the rest of the Wheat, of which about 100 acres were grown. It was further remarked that in an experience of many years the observer had not previously noticed this kind of attack.

The reason of this unusual amount of Aphis-presence is presumably that the drought was favourable to the increase of the insects, both by suiting them and by keeping the crop in a condition in which the sap was suitable for their quick development and consequent rapid increase,

With regard to methods of remedy, it does not appear possible to do anything to get rid of the plant-lice when lodged in the corn itself, unless some help might be got from small insectivorous birds, as Tits,

&c. This is very doubtful; but at any rate it should be borne in mind that the universal pest, the Sparrow, appears, as far as evidence goes, to be doing us harm on the Corn "with both hands." Other birds may knock out Corn whilst they are searching for insects, but he takes the Corn, leaves the insects, and also, as far as in him lies, drives away the small birds that might have helped. For other evidence of his misdoings see paper on "Sparrows."

Whether measures of prevention of Aphis-attack are possible is not certain. We want to know how the Aphis passes the winter in this country. In the United States it has been found, by the observations of Dr. C. Thomas, late State Entomologist of Illinois, that the Aphides might be found on the leaves and stalks of the winter Wheat when it appeared above ground; as cold increased some might be found in the ground, and feeding on the sap of the roots; and late in the winter, and when snow was on the ground, they were to be found busy at work, and the females bearing well-formed larvæ.*

Dr. Asa Fitch, the well-known United States' entomologist, also states that he has watched the "Grain Aphis" closely all the year round, and found that in the autumn the mature lice continued to produce their young ones until they and their young were frozen, and then buried in the snow, and with the warmth of the ensuing spring they were thawed and came to life again.†

Mr. Buckton, our own great authority on Aphides, has examined roots of Wheat for presence of "Grain Aphis" in September, but has not found them present; but search in various localities later in the season, when cold had set in, might lead to the plant-lice being found in their winter localities; and it would be very serviceable to have regular agricultural observations as to whether the Aphides were found at the roots of Wheat or of wild grasses in headlands; also whether they were to be found on the early winter Wheat in autumn, or again, on the leafage when the cold of winter had passed away.

The Aphides infest many of the common grasses, and, if found in such places, it is obvious that autumn and winter cultivation, to break up the sheltering land, or strong dressings, by which the lice might be poisoned on the surface like other insect-pests in regular process of farm-work, would be useful. Two notes forwarded in previous years mention bad attack of these plant-lice after clover-stubble or layer.

More information is greatly needed before we can get hold of the means of prevention of this attack; and, besides the above-mentioned points, it would be very useful to know whether Corn, which by reason

* See 'Third Annual Report on Noxious and Beneficial Insects of the State of Illinois,' by Dr. C. Thomas, pp. 53, 54; also extracts from the above in 'Report on Injurious Insects for 1883,' by Editor, p. 26.

† See 'Eighth Annual Report of Entomological Society of Ontario,' p. 32.

of being autumn-sown, or from kind, or treatment, or circumstances of climate, ripened early, and so was hardening before the great burst of Aphis-attack appeared, escaped better than what was then still in a state in which the suckers of the plant-lice would be driven into the ear at the base of the grain.

The amount of damage caused is stated at various localities respectively as—the whole of the Oats and Wheat of the district being attacked, and yield likely to be seriously injured; quantities of ears of Wheat, Barley, and Oats in another district shrivelled so as only to yield small corn, say 5 per cent. loss; and likewise serious damage to portions of fields. In 1879 the damage on a field of 110 acres near Northwich, Cheshire, then reported by the occupier, was estimated as reducing the crop which should have been four to five good quarters to ten to twelve bushels per acre, and of inferior quality.

Daddy Longlegs. *Tipula oleracea*, Linn.



TIPULA OLERACEA.

Daddy Longlegs, eggs, grub, and chrysalis.

The most important communication on the subject of Daddy Longlegs grubs during the past season is the following, for which I am indebted to the courtesy of Messrs. James Laut and Co., Prince's Quay, Londonderry, Ireland. The great amount of damage brought under the notice of the firm by correspondents in communication with them relatively to furnishing supply of Oats for export, induced Messrs. Laut to draw attention to the desirableness of doing something towards lessening the ravages of the grubs, and the following

letter with which I am favoured by them, from Mr. S. Osborne, Springtown, near Londonderry, appears well worth notice, amongst other points, with regard to preparation of the ground. There is no doubt that a difference in the method of cultivating the surface of the land has an effect on amount of increase of some kinds of crop-insects, independently of all other considerations, and (without going back to bygone methods of cultivation) the effect of some of these may help in showing which of those of the present day will act best on the grubs, as well as for ordinary agricultural purposes.

In the following notes Mr. Osborne draws attention to the *trenching*, which disposes of the grubs so deeply down that they have difficulty in coming up again; the double-furrow plough, that presses the clods together, and turns the sod smaller and lighter for the harrow to break up, is also in a different way good for getting rid of the grub; whilst another form of ploughing is noticed as, though good in itself, being at the same time especially favourable for grub harbouring. Mr. Osborne first remarked:—

“I promised to give you a short report of my experience of the grub-worms.

“I have only made their acquaintance within the last twelve or fifteen years on the farm; prior to that they were little known in this neighbourhood. This fact, to start with, suggests many questions. *How much is the cultivation altered, and how much does the present system contribute to their increase?*

“I believe our predecessors destroyed the eggs more than we now do by the *spade in ridging and deep trenching*, cultivating but a small area, and not being obliged to level the land for the mowing machines, the grub made less ravages.

“The grubs do not make such headway when there are deep-trenched furrows, and they have been seen lying helpless in these trenches in hundreds. I find that rolling is no preventive. Ploughing has somewhat to do with them. The best ploughman in lea-land generally has the worst crop after him in Oats, from the fact that in setting up and making a good ‘cone’ as a seed-bed he only makes the better cover and shelter for the grub. The furrow turned flat over is best, but the double-furrow plough has proved to me the best implement, as it presses the furrows together and turns the sod over *much smaller and lighter for the harrow to break up*, for it is in the crevices of the furrows the grubs lie and suck the milk of the grain, which is much worse than the cutting of the blade.

“In my experience any chemicals applied for their destruction when they begin to make their ravages must destroy the grain. I have had them covered with salt and soot over night, and they have been alive in the morning.”

[This observation quite agrees with the result of the experiments of Mr. Ralph Lowe (noted p. 26 of Report for 1884), in which grubs covered respectively with quicklime, soot, household salt, and superphosphate, and also some placed in earth mixed with one-fourth of white arsenic, were not at all the worse, excepting those that had been in the arsenic, and even these recovered before the following day. But nitrate of soda had much more serviceable effects.—ED.]

Mr. Osborne continued :—"Prevention in my opinion lies in the cultivation long prior to the sowing of the seed, and the only chance is to destroy the egg by constant stirring of the land during winter and up to sowing-time, paring the lea lightly now [communication sent in autumn, ED.], pulverising with heavy harrows at different intervals up to the final ploughing for the seed-bed, which should be as late as possible. Chemicals might and could during this operation be used successfully both in the destruction of the egg and the encouraging forward of the crop. Hot lime, gas-lime, soot, salt, and nitrate of soda incorporated into the soil, all help to pulverise and make it near to potato or turnip land, where I have never known them work." [Unfortunately this absence cannot be looked for as a rule, ED.] "If a man is not able to overtake this extra work, his only chance in lea remains in small furrows, and the use of three-horse harrows deep and sharply-pointed, to bring the land into a friable state.

"The grub does not do all the harm when lea is ploughed in the usual way, and the furrows left unbroken. The cold easterly winds which we had this spring gets easily at the tender plant when it is openly ploughed and badly harrowed. This is my experience so far as cultivation is concerned.

"There is another fact I wish to bring under your notice. Our predecessors were not much given to house-feeding, but allowed their cattle to range over the fields in winter, and left no such cover of grass in autumn to protect the eggs as we now do. To illustrate this fact, I had forty acres of lea out this year (twenty of which had been out seven years); I expected to get the usual eating up, but I took the precaution of allowing all the cattle I could get on it during the winter. A favourable opportunity for this offered in short shipments of cattle from the port. Owing to the strictures of sending by Derry, the only port in the North free from foot-and-mouth disease, the shippers were obliged to send them to me to wait for the following boat; consequently I had hundreds upon the land, night after night, during the winter: the result was I had never such a crop of lea out. That proves that the tramping and close grazing destroys the eggs. It is also noticeable the headland never suffers to the same extent, from the fact that it is closer grazed and more trodden in shelter of the fences. When

we have a heavy black frost, which cuts the shelter, we have less destruction from the grub."

[The serviceableness of feeding sheep or cattle on pastures or Clover-ley before breaking up as a means of prevention of insect-attack is a subject of so much importance that it may be well to refer the reader to various observations on this subject given in the "Report on Wireworm," printed in the 'Journal of the Royal Agricultural Society,' part i., 1883, and in my own 'Report' for 1882, published 1883. The practice is strongly recommended there as a means of preventing Wireworm-attack, and it would be even more useful to get rid of the Daddy Longlegs' grubs, in which we have to deal with a pest that only lives some months, whereas the Wireworm lives several years. --ED.]

Another large farmer, contributing through Messrs. Lauts' hands, mentioned that "he has no grub. He gives the lea a ton of salt to the acre, and allows it to lie thereon, thus destroying grass and leaving no shelter or covering for the eggs." After sowing he doubly rolls the land to press it close. All seem to agree on the advantage of keeping soil close.

A few reports from localities in England mentioned bad attack, but did not add new information to the methods of treatment noted in preceding Reports.

Garden Chafer; "Chovies." *Anisoplia horticola*, Curtis;
Phyllopertha horticola, Kirby.



PHYLLOPERTHA HORTICOLA.

Chafer, nat. size. Chafer and grub, magnified.

The following note refers to an appearance of the small Chafers, perhaps best known as Garden Chafers, of which the grubs are sometimes as mischievous to grass-roots as those of the common Cockchafer. One of the peculiarities of the beetles is the enormous numbers in which they occasionally congregate on various plants or trees,

On June 18th specimens were forwarded by Mr. Simeon Leather, Delamere Lodge, near Northwich, Cheshire, with the information that the small beetle had that day made its appearance in his Potato-field. He observed:—"The beetles are flying in thousands over the field, and are also on the ground in great numbers. They appear to have been emerging from holes in the soil."

A few days later, on June 30th, the beetles had so far disappeared that they were not to be seen in any great numbers together. Grubs resembling small Cockchafer grubs had been observed in the same field in the previous year, "when ploughing up the grass-sod for Corn; so no doubt they had then been feeding at the grass-roots."

These Chafers are of the shape and size figured at p. 22, and may be easily known by the bright green colour of the head and fore body; the under part and legs are greenish black, and the wing-cases bright tawny.

The beetles are to be found more or less, and sometimes in great numbers, early in the summer, and frequent many kinds of plants. I have chiefly seen them on roses, and on grass in park-land; they do damage by eating pollen or flowers, or sometimes resorting to Wheat and Oats in corn-fields, and are known under many names. "Garden Chafer" appears as convenient a name as any, but they are also known as "May Bugs," which is somewhat confusing with the true Cockchafer; "Bracken Clocks," from frequenting fern; likewise as "Rose Beetles"; and "Chovies." But it is in the grub-state that they do the most harm; and, as I am not aware of any description of their habits so full as that of John Curtis's having been published, I append his observations in the accompanying note.*

* "The female, having deposited about a hundred eggs in the earth, dies, and the larvæ hatch and commence their attacks upon the roots of the grass. Although they are mischievous in gardens, it is in pasture-lands and lawns that they commit the greatest ravages; by their consuming the roots the grass dies." . . . "These larvæ are very similar to those of the Cockchafer, but much smaller; they generally lie curved up somewhat in the form of a horse-shoe (fig. p. 22); yet they are rather active, and can walk tolerably well, dragging their heavy bodies after them; they are of an ochreous-white colour, but the head is deep ochreous; . . . the mandibles are somewhat rust-coloured and black at the tips; . . . on the breast and immediately behind the chin are six longish legs." . . . "They form cells of the surrounding earth at a considerable depth in the soil they inhabit, where they undergo their transformation into delicate pale-coloured pupæ." . . .

"It is stated that they continue feeding for three years, and they generally reside about an inch beneath the turf, but as winter approaches they retire deeper into the earth, and even in November, when frost has set in, they have been found buried a spade deep. From the large size of most of them at this period I expect they are generally full-grown and prepared to enter the pupa-state, for which purpose they form cells in the earth, and in all probability remain in that quiescent state until the following spring, when the beetles emerge about the time the roses flower."—'Farm Insects,' pp. 221 and 509.

With regard to the length of life of the maggots before changing to chrysalids, which is a very important practical point, it will be noticed Curtis only observes "it is stated" that they continue feeding for three years, and further on remarks, as his own opinion, that from the large size of most of them at the beginning of winter, he expects they are generally full-grown and prepared to enter the pupa-state; and it is distinctly stated by Dr. E. L. Taschenberg that the grubs do not live a full year ('Insekten kunde,' part 2).

Various applications have been suggested as being likely to destroy the creatures, but it is a very difficult matter to kill a maggot that lies at least an inch beneath the surface without hurting growing grass, and it seems very doubtful whether any watering, such as dilute gas-water, or any dressing, would answer well enough to pay the cost of application; something, however, might be done to prevent attack. When the beetles come in the great numbers in which they appear from time to time, they are observable at once on the grass, and surface dressings put on *at once* of lime and salt, salt and ashes, or paraffin and ashes, would be very likely to be of use in making the surface unattractive to them, or by poisoning the young maggots as they hatched. Brushing the surface would also be a preventive.

Where grass-land, which is infested, is to be broken up, it is a great object to do it whilst the grubs are still near the surface,—that is, before they have gone down for the winter,—and in this case a good dressing of gas-lime (such as mentioned in the extract from Dr. Voelcker's pamphlet 'On the Composition and use of Gas-lime' at p. 5 of this Report) would be very desirable. Pigs put on at once would clear the grubs well, but all applications should be made immediately on turning the ground, or the grubs would soon bury themselves out of harm's way.

The beetles may sometimes be destroyed by shaking them down, as they congregate in large numbers, and if this is done at the time of day when they are quietest many may thus be got rid of.

Haulm Fly; Ribbon-footed Corn Fly; "Gout"; "Poddle."

Chlorops tæniopus, Curtis.

The attack of *Chlorops tæniopus*, or Haulm Fly, which causes the swollen condition of Corn-stems commonly known as "Gout," is not often brought forward, though, from my own observations in different parts of the country, I should say this was not from want of damage, but from the distorted growth looking to general observers as if it was caused by some vegetable disease rather than by insect-attack.

The following note is by Mr. T. H. Hart, late of Park Farm, Kingsnorth, Kent :—

“*Gout* or *Poddle*.—Almost every piece of spring-sown Oats or Barley that I walked through was suffering more or less from attack of *Chlorops tæniopus*. In some cases it was of serious importance, in



CHLOROPS TÆNIOPUS.

2—6, 11, maggot, chrysalis, and fly of *Chlorops tæniopus*, nat. size and magnified; 7 and 8, *Cælinius niger*; 9 and 10, *Pteromalus micans* (parasite flies), nat. size and magnified; 1 and 12, furrowed corn-stem.

others but trifling; still there it was, and the field that looked so level and nice from the outside betrayed its weakness on walking through it. The Wireworm-struck Oats mentioned were severely attacked by this fly after the worm ceased to trouble it, and at harvest-time it was a wretchedly untidy piece of Corn, single straws, 4 ft. long, crippled down, and surrounded by numbers of weakly backward heads varying from a few inches to some 2 ft. in height.

The *Chlorops* is a small, very thick-made, two-winged fly of the size figured above (fig. 2), yellow, with three black stripes along the back between the wings, and having the abdomen greenish black with black cross-bands (see fig. 3, magnified).

The attack affects various kinds of Corn, and in this country appears to be most hurtful to Barley. With regard to the method of attack, it has not yet been fully recorded in this country, but by comparing English and German observations it appears to be as follows :—*

* See ‘Farm Insects,’ by John Curtis; and ‘Praktische Insekten kunde,’ pt. iv. by Dr. E. L. Taschenberg.

There are two distinct forms of attack, one that in some degree affects the winter plant, but does harm mainly by keeping up the pest to attack the crop in the following season, which the succeeding brood then injures by causing not only distorted growth, and more or less abortion of the ear, but also unevenness in date of ripening, very inconvenient in harvesting.

The fly appears to deposit her eggs for this summer attack either on the ear or at its base, whilst still very young, or to place its eggs, one or two at a time, on the sheathing leaves, so that the maggot on hatching can make its way to the ear then in an early stage of its development within them. Here the maggot feeds, and the channel caused by its gnawing may be readily seen by opening a "gouty" head of Barley, where a brown furrow will be found running from the base, or possibly from a little above the base of the ear down to the first knot. This injury, of course, distorts and affects the growth of the top of the stem, and consequently the diseased ear is often to be known by being still in its sheathing leaves when others are free, and likewise deficient in size and in grain, and the stem-part often swollen.

In this furrow the chrysalis, to which the maggot turns, may be found in the ripening or ripened Corn, and in autumn, where attack has been bad, the flies may be found in legions in recently-stacked Barley. I have myself found them in such vast numbers in one part of a stack that they fell with a noise like dropping sand from the handfuls of Corn I pulled out of the stack over a paper held below.

The winter attack, as observed in Germany, is from these flies laying their eggs on late-sown Corn or wild grass. The maggot pierces into the neck of the plant and there winters, and in spring the diseased shoot forms a thickened growth with wide leaves, but the rest of the plant has not been found to be affected. The diseased shoot appears to die away gradually whilst the Haulm Fly goes through its changes within, and comes out at the right time to start the summer attack, as mentioned above.

From some slight observations or passing remarks this winter form of attack appears to exist in England, but I am not aware of it having been recorded in detail.

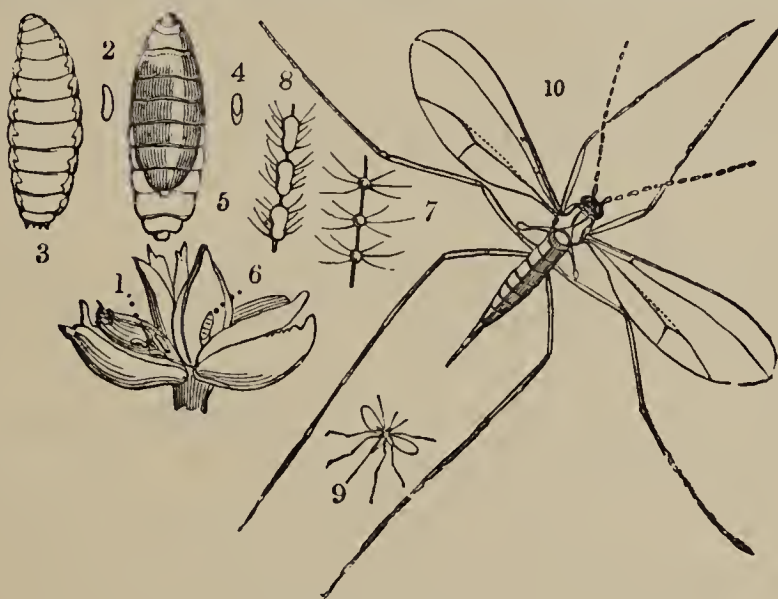
With regard to methods of prevention: the attack, as far as recorded, and as far as I have seen it myself, is worst on wet parts of the field, or along the water-furrows, or near grass headlands, where the ground was sheltered or damp; and where attack recurs, as it sometimes does each time Barley or Oats are grown in some special locality, the state of *drainage*, or the condition of the soil, should be seen to. The maggot itself cannot be acted on by dressings whilst wrapped in the growing shoot, but, as the injury consists in the

distorted and retarded growth of the attacked shoot or Corn-stem, it is probable that artificial dressings applied in the early stage of the summer attack would do much good.

One hundredweight of nitrate of soda, with two hundredweights of salt, to the acre would be a good application, by the fertilising power of the nitrate joined to the special effects of the salt. Guano and salt, or guano and superphosphate, would also be likely to do good, applied when first attack is noticed on the young plant.

Drawing out and destroying the badly-attacked plants, which are especially to be observed along the water-furrows and edges of crop near grass headlands, is desirable, as a means of prevention of future attack ; and likewise, where the little stumpy-made black and yellow flies are found in the great numbers in which they sometimes are observable at threshing-time, they should be swept together and destroyed.

Red Maggot; Wheat Midge. *Cecidomyia* (? *tritici*), Kirby.



CECIDOMYIA TRITICI.

1—6, larvæ, nat. size and magnified ; 7 and 8, part of horn, magnified ; 9 and 10, Wheat Midge, nat. size and mag. ; infested floret.

The following note by Mr. T. H. Hart, late of Park Farm, Kingsnorth, Kent, refers to the presence of different kinds of Red Maggot in Wheat ; last year notes furnished by Mr. Hunter, and Mr. Edmund Baillie, of Chester, showed the presence of the common Red Maggot, and likewise another kind, which might possibly be a small variety, but was considered by Mr. R. H. Meade to be probably a new or undescribed species, on the Common Foxtail Grass.

The existence of various kinds of Red Maggot, and the extent to which they affect different varieties of Wheat, or on occasion affect other kinds of Corn or wild or cultivated grasses, would be a serviceable

matter for report, as leading to a knowledge of points at which to look for attack.

The following note refers to the first observation by Mr. Hart of the attack in the field of the Midge Maggots, of which further details are afterwards given.

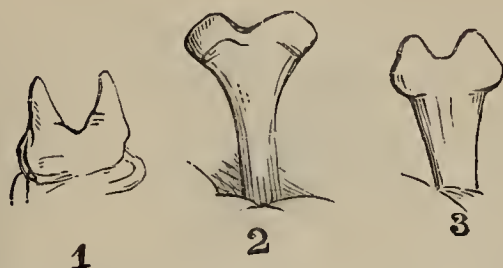
“ *Yellow Maggot*.—On July 30th, when inspecting a piece of Wheat, I removed a set each from three different ears, and examined the contents of the chaff. In place of the clevel was thirteen, ten, and twenty-seven Red Maggots. I had noticed the presence of maggot a week or ten days before, but had no time then to examine the ears carefully. On the above date, and subsequently, I found that, as a rule, only one set in each ear was attacked; when more than one the number of maggots in each set was smaller. This Wheat, the produce of $6\frac{1}{4}$ acres, was threshed Sept. 8th, and yielded 29 qrs. of clean grain. On the under side of the threshing machine was a fine sieve, which screened small seeds from the grain as it passed over it. Beneath this sieve about half a bushel of almost pure maggots were caught, besides what were blown out and were separated with dust from the chaff at another place. Of this dust, &c., some fifteen or twenty bushels were collected and burned, and the proportion of animal matter contained in it was so great that not till the third day could we get it all consumed. Another indication of the large quantity of maggots there must have been in it was the terrible stench that arose from the burning mass.”

On the 9th of September Mr. Hart forwarded a packet of Wheat threshings swarming with bunches of Wheat Midge maggots, with the following remarks:—

“I send you a sample taken from beneath the machine with which we have threshed some Essex Wonder Wheat. This year I have tried the above variety of brown or red Wheat for the first time, and I never had a worse attack of Red Maggot in any kind. A piece of Golden Drop in another field hard by is comparatively free from Red Maggot. I have given instructions for all the dust that falls beneath the machine to be burned. You will observe in the sample sent another larva larger and more amply coloured than the Red Maggot. This is a stranger to me.”

This larger and redder maggot corresponded with the description of the maggot of the Barley Midge, *Cecidomyia (Tipula) cerealis* of Sauter. It was about four times as large as the Wheat Midge maggots sent accompanying, and of a full red; a vermilion, or red-lead colour. It was distinguishable microscopically from the common Red Maggot of the Wheat by the shape of the “anchor process.” This is a minute process attached, pointing forward, to the under side of the maggot a little behind the head. The form varies in different kinds

of *Cecidomyia* larvæ or “red maggots,” as they are called, and is one of the best means of distinguishing the different species. In the true Wheat Midge maggot this minute process is as figured (fig. 2), slightly



2, Anchor process of Wheat Midge maggot ; 1 and 3, of Foxtail Grass maggot.*

convex, with a blunt notch scooped out at the end, which lies free and pointing forward.

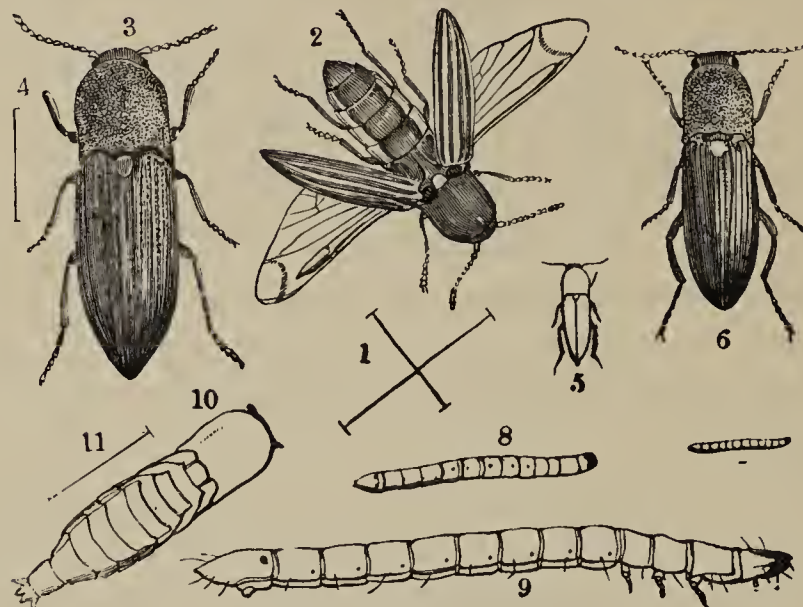
The “anchor process” of the larger or Barley Midge maggot (not figured) was distinctly different in shape, being almost flat across the free end, or very slightly saucer-shaped. What the use of this process may be has not, as far as I am aware, been brought forward, but scarcely seems to admit of a doubt. From the different forms which occur in different species of maggots of the genus living respectively on hard or soft matter, as, for instance, the blunt-ended processes of the Wheat maggot, and the strong almost hooked cruciform process of the Red Maggot of the Willow (also from careful examination of the condition of the cell of the Willow maggot immediately on opening it), I conjecture that the instrument is used as a kind of scraper to work off minute fragments for food of the maggot, or sometimes to form the hollow cell in which it lies. The mouth-parts appear too delicate for this work ; and, in the case of the Willow maggot, which forms a cell large enough to hold itself beneath the bark or in the wood of the Willow, there appears no possible way in which this could be cleared out but by the help of its “anchor process.”

The Barley Midge maggots live in parties between the stem and sheathing leaves of various kinds of Corn, causing thereby a deformed growth, or sometimes complete destruction. When full-fed the maggots go down into the earth to complete their changes. The Gnat Midges appear about May or June of the following year, and are much like the Wheat Midge figured (p. 27) in shape, but of a darkish or rusty-red colour, with a pair of silvery wings. As the maggots lie in the ground during winter, any operations which will throw them on the surface, or skimming, and then collecting and burning the Corn-roots in which they lie, will be of service.

The great amount of damage to Wheat caused by Midge-maggots, and notes of its life-history, &c., have been given in previous Reports.

* The illustrations of Foxtail Grass maggot refer to notes which they accompanied in Report for 1884.

Wireworm ; Grub of Click Beetle. *Elater (Agriotes) lineatus*,
Linn. ; and various other species.



ELATER LINEATUS, &c.

1 and 2, *E. lineatus* ; 3 and 4, *E. obscurus* ; 5 and 6, *E. sputator*, nat. size and mag. ; 7, larva of *E. sputator* ? ; 8 and 9, larvæ of *E. lineatus*, nat. size and mag. ; 10, pupa. Lines show natural size.

The fact that by far the largest amount of Wireworm-attack takes place on crops which have been put in on land broken up from pasture and Clover-ley, without having undergone requisite treatment, is constantly more and more brought forward.

It is plain that this is to be expected, because, as in the natural course of things the parent beetles lay their eggs beneath the shelter afforded by such crops, the young grubs are certain very shortly afterwards to be present, and, as these Wireworm or Click Beetle grubs live for some years there,—that is, in such localities when broken up,—we are sure to have, amongst the grass or clover roots, a supply not only of the newly-hatched Wireworm, but of those which have been living there for one, two, three, or four years before the breaking up of the land ; and, as they feed on almost all kinds of common field crops, excepting Mustard, the damage which costs so much year by year is certain to ensue.

But there is no reason this should be allowed to happen. By the various measures which are constantly practised by some of our best agriculturists, and which lie quite in the scope of regular farming operations, the land may be made so unsuitable for egg-laying and poisonous to the hatching “worms” that little or no attack will be established in the autumn before breaking up, and likewise a good proportion of the pests already established will be destroyed.

As these points were entered on in detail in the Special Report on Wireworm, and means of prevention of its ravages, prepared from the

observations of a large number of agriculturists in 1882,* I do not repeat them now; but at present there is one point sometimes too much lost sight of, and that is the great effect in lessening amount of presence of grubs near the surface of the land, which is brought about by feeding stock on it as heavily as can be done.

Thus insect shelter is got rid of, likewise much of the attraction to the spot is got rid of by substituting the presence of sheep or cattle, and a changed condition of surface of the pasture consequent on their presence, for that of the pure grass; and where (as mentioned in detail in the Report) stock can be hand-fed on patches hurdled in successively, so that the whole surface is trodden and impregnated with the droppings, the effect has been excellent.

The following notes refer to observations undertaken by Mr. D. Sturdy, of Trigon, Wareham, relatively to special effect of rape-cake on Wireworm.

An idea was at one time prevalent that the way in which rape-cake is of service in Wireworm-attack consists in the Wireworms eating it till they burst. As it is of considerable importance to know the exact way in which the application of rape-cake is beneficial, some special experiments were set on foot to prove (or disprove) the above views; and in those carried on by myself with Wireworms that were allowed nothing but rape-cake to feed on, I found no bursting took place.

In order to try the experiment on a more complete scale, Mr. Sturdy undertook some further observations, commencing in March, 1883, and continuing until September, or somewhat later, in 1885.

The experiment was begun by sowing two boxes of earth with Oats (in March, 1883), and, when about two inches high, one box was "well-larded" with bits of Indian rape-cake about the size of hazel nuts, and an equal number of Wireworms were placed in each of the two boxes. The Oats with the rape-cake flourished greatly compared with those in the other box, which were a good deal injured by the Wireworms, whilst the rape-cake Oats were hardly touched by them; and on May 1st, on examination of the Wireworms in the rape-caked box, these—"everyone"—were found looking fat and well.

On January 31st, 1884, Mr. Sturdy further reported:—"On looking at the boxes I found that the lot that had Oats to feed on became ordinary Click Beetles, but that those that had E. Indian rape-cake *only* were still large and well-to-do-looking Wireworms, and so they still remain to this day" (Jan. 31st).

* "Report on Wireworm," 'Journal of Royal Ag. Society for 1883,' part i., by Consulting Entomologist of the Society; 'Report on Injurious Insects for 1882,' published 1883, by Editor. Simpkin & Marshall.

“The result of the experiment is that the rape-cake, instead of being poison to the Wireworms, evidently prolongs their destructive lifetime. How long they will continue to live and flourish in the rape-cake you sent me and water I can at present form no opinion.”

On the 1st of May following (that is a little more than a year from the commencement of the experiment in 1883), Mr. Sturdy again examined the Wireworms, and reported:—“They look fat and well, after feeding on nothing but the rape-cake you sent me for many months.”

On Dec. 12th in the following year (1885) Mr. Sturdy reported the completion of his experiment as follows:—“The Wireworms, about which I wrote you two or three years ago, are now all dead or changed into Click Beetles, but the last three of them lived *as Wireworms* entirely on the rape-cake you sent me until September.”

We have thus an experiment extending continuously over a period of two years, and more than six months, of which the results stand as follows:—

The Oats which were manured with the rape-cake grew much better, and were much less injured by Wireworms than the Oats grown without cake.

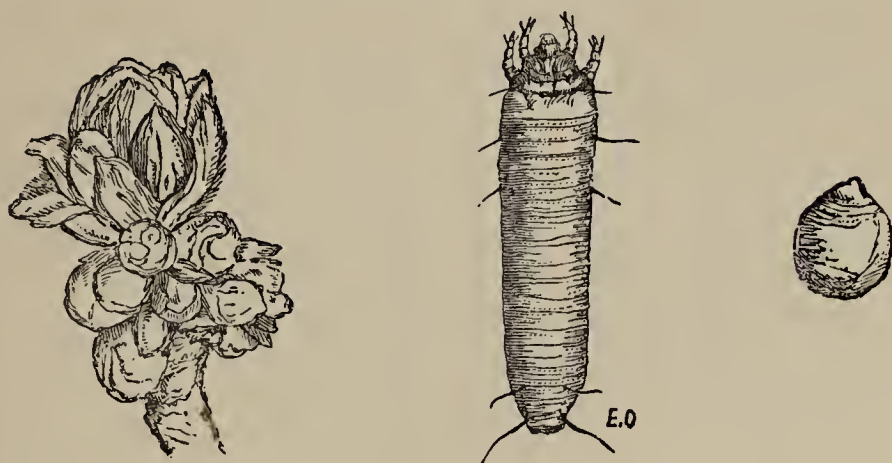
The Wireworms throve on the cake, whether with the addition of small amount of Oats to their diet, or on the cake alone.

It is observed that whilst those that had Oats turned to Click Beetles in due course, the development was checked in the case of those fed on cake alone. This in itself is a consequence by no means to be desired, but where there was mixed food attainable at pleasure would probably not take place; but, relatively to the special point of bursting, nothing of the kind occurred during the whole course of the experiment.

In my own observations, I experimented both with the common rape-cake and with what is called E. Indian or Currachee rape-cake, which is, in fact, mustard-cake; but I supplied Mr. Sturdy with the latter, as I wished to know whether it might have any special effects, and we ascertained fully that with neither of the kinds did bursting follow the absolutely certain and regular feeding of the Wireworms on the cake.

CURRANT.

Black Currant Gall-mite. *Phytoptus ribis*, Westwood.



PHYTOPTUS (? sp.).

Gall-mite and egg, enormously magnified. [Infested Birch buds.*]

The *Phytopti*, or Gall-mites, are excessively small creatures of the shape figured, which live together in large numbers, and give rise to diseased plant-growth, often in the shape of galls on the leaves, sometimes, as in the case of the Black Currant, Nut, and Birch, by causing an abortive growth of the leaf-buds.

They are not true insects, but, like the “Spinning-mites” (the so-called “Red Spiders” so injurious to the Hop leafage), belong to the order of *Acarina*, or Mites. The subfamily of the *Phytoptidæ* are distinguishable by their peculiar long, somewhat cylindrical, shape, and by having only two pairs of legs placed close together beneath the fore part of the body, which ends in a kind of conical projection containing the mouth-parts. The details of those of the Black Currant Gall-mite have not been described (so far as I am aware), but those of the Pear-leaf Gall-mite consist of excessively fine sword-shaped jaws fitting on each like scissor-blades,† these being contained, with other minute apparatus, in the somewhat conical proboscis.

The skin is much wrinkled across, and the mite, besides its two pairs of legs, is furnished with various large bristles, regarding the nature of which there has been much discussion. The creature, being excessively minute (so that the smallest dot visible to the naked

* The buds on the Birch shoot show the form, though not the arrangement, of those on the Black Currant shoots. Not having command of a figure of Black Currant attack the above is given, with further explanation in the following paper, as being clearer than mere description. For figures of seven kinds of *Phytoptus* attack, by Editor, including that on Black Currant, see ‘Economic Entomology: Aptera,’ by A. Murray, article “Gall Mites,” pp. 355—361.

† For further details of the Pear Gall Mite, see ‘Der Milbensucht der Birnbaume,’ von Paul Sorauer.

eye would be too large to convey an idea of the size), there is great difficulty in saying with any certainty whether various attacks to various plants are caused by one or various species of the mites.

Where I have traced the life-history the mites hatched (in the same shape and with the same number of legs with which they continued through their lives) from an egg,* which was of a perfect egg-shape at first, but which became, towards hatching, very irregular in form, being pushed out by the pressure of the mite inside, which I saw in the act of coming out. As the mites grow they cast their skins, and these empty cast-skins may be found among the living multitudes.

The injury to Black Currants consists in the mites, which shelter themselves in the buds, feeding on the outer surfaces of the embryo leaves, and setting up a diseased growth, which first causes a swollen condition of the bud, distinguishing it very plainly from those in a healthy state, and at last renders the whole, leaf-bud and flower-stem together, abortive.

On March 25th specimens were forwarded by a correspondent, showing exceedingly bad attack of the gall-mite to Black Currant shoots. On two lengths of about three inches of the shoots sent there were as many as six or seven swollen buds, and on another piece there were about seven of the swollen distorted buds.

On May 7th specimens of Black Currant twigs badly infested by *Phytoptus* galls were forwarded from the neighbourhood of Cottenham, Cambs., by Mr. Arthur Bull, with the information that there was about half an acre so affected. The attack had been coming on for about two or three years. Three years ago these bushes bore an enormous crop, and ever since then had been getting worse, until the specimens sent were a fair sample of the condition of the whole piece. Another kind of Currant growing near was stated not to be attacked.

The figure of the infested Birch shoot shows the shape of the infested buds, some small, some, as the bud at the end of the shoot, partially developed; but in Black Currants they are not massed together, as in this figure of Birch attack. Sometimes the shoot is stunted, but often the shoot remains uninjured, and the buds, though infested, are still at the natural distance from each other.

The best remedy for moderate attack is to cut off attacked shoots and burn them. This would answer well at first, but if attack is established it is very troublesome to get it under, as the mites stray about and shelter under rough bark or in crannies near the ground, and are almost certain to come out again from them to cause new injury. The various remedies used for Red Spider are desirable, and

* See "Notes on the Egg and development of the *Phytoptus*," by E. A. Ormerod, in 'Entomologist,' vol. x., p. 280.

especially mixtures of sulphur and soft-soap applied as syringings ; these run down the shoots and lodge in the crannies and between the buds and the stem, and thus clog up the nooks which shelter most of the mites not in the buds.

The following recipe, given by Mr. Arthur Bull, would probably be very serviceable, as boiling the sulphur with some lime would make it dissolve :—

“I use a dressing of two parts sulphur and three parts lime boiled together in water (2 lbs. sulphur and 3 lbs. lime, 3 galls. water), which is further diluted at the rate of two or three pints to a large pail of water, applied with a syringe to the infested bushes ; the effect is to keep the ‘spider’ down, and that little or no damage is done. It seems difficult to clear the garden altogether.”

Another recipe, to save the trouble of boiling the lime, is as follows :—Take of sulphuret of lime 4 ozs. and of soft-soap 2 ozs., to each gallon of hot water. The soap and sulphuret to be well mixed before the addition of the water, which is to be gradually poured on, stirring being continued during the process. This mixture may be used as a syringing, but, if poured in thick condition on the stems about a foot or two from the ground and let run down into the centre of the bushes, it would choke myriads of the minute creatures. Good waterings, and all treatment calculated to promote hearty growth, would be likely to be of service.

Where attack is as bad as that described by Mr. Bull, probably the best treatment is to clear the bushes and burn them (or any rubbish at hand) *where they stood*, or to put a couple of shovelfuls of fresh gas-lime where each bush stood, so as to kill the mites that may remain. They cannot fly, but are easily dispersed on leaves blown by the wind, or by crawling.

The attack is considered to be worst in North Britain, but it certainly comes as far south as Isleworth, as it appears slightly in my own garden.

Magpie Moth ; Currant Moth. *Abraxas grossulariata*, Stephens.

The caterpillars of the Magpie Moth sometimes do a great deal of mischief, both in gardens and fruit-farms, by stripping the Currant and Gooseberry leafage.

The following note regarding their appearance was forwarded by Mr. S. L. Mosley, Beaumont Park, Huddersfield, who also remarked, regarding the plant which he noticed to be preferred for food :—
“Most of my observations of Magpie Moth have been on Currant,

sometimes on Gooseberry; but I believe they prefer Currant. In one garden the Currant bushes were stripped, and Gooseberries not touched, though within a few feet.

“The Magpie Moth has been more numerous than for many years before. Here it has been abundant in one or two places, and has



ABRAXAS GROSSULARIATA.

Magpie Moth.

entirely stripped the bushes. I have also seen it commonly in Cambridgeshire, Lincolnshire, Notts, and parts of Yorkshire, and I have notes of its extreme abundance near Bradford, Ilkley, Pickering, &c. In places where the trees can be bent over and shaken all the caterpillars drop, and it is easy to pick them up, if gardeners would be at the trouble. In some of the places where Magpie grubs have been abundant I know that Sparrows are plentiful, so it is clear they do not take them, or at least, if they do, not to any great extent.”

The Magpie Moth is widely distributed, and the caterpillars injurious from the Orkneys to the South of England, and, besides the leafage of Black, Red, and White Currants, and also of Gooseberries, which they habitually feed on, they are sometimes found on that of Apricots and Plums, and especially frequent Sloe or Blackthorn hedges. In various instances in which attack has been reported on Blackthorn (and sometimes as occurring to a great extent), attack to the bush-fruit leafage at the locality has not been reported, or has been mentioned expressly as not being to a great extent. I have myself observed in W. Gloucestershire, in a locality where there were large Sloe hedges, that there was little injury from the Magpie caterpillars to fruit-bushes in the garden, and it is worth observing whether this very favourite wild food-plant may not attract the moth from the garden bushes.

The moth is very variable in its colouring, but when regular in its markings is easily known. The wings are white spotted with black, and the fore wings are yellow at the base, with a yellow band across them. The body between the wings is yellow. The caterpillar is cream-coloured, with an orange stripe along each side, and black spots along the back. It is also orange-coloured beneath six of the segments, and the 2nd segment wholly orange-

coloured. The very gay colouring distinguishes it clearly from the greenish or green and black-spotted caterpillar of the Gooseberry Sawfly, which is still more common and destructive, and the habit of the Magpie caterpillar of raising itself into an upright loop as it walks is another distinction.

The egg is laid on the leaves during summer, and the caterpillars appear towards August or September, and feed for a while. Before winter they secure themselves either by spinning themselves up in leaves, which hang by spun threads from the boughs, or by dropping with the leaves and sheltering themselves at the surface of the ground. Next spring the caterpillars come out again and feed on the new leafage, till towards May or June they spin a light cocoon, in which they turn to a yellow chrysalis, which presently changes to black and orange colour, from which the moth comes out towards the middle of the summer.

The habit of the caterpillar of wintering on or under the food-bush is *the* one to be acted upon to get rid of it thoroughly. Very early autumn pruning and dressing of the ground beneath the bushes should be avoided. I have notes from two localities where this was customary of caterpillar-attack being bad, and the reason seems obvious. If the caterpillars have either not become thoroughly torpid, or the weather still is open enough for them to re-establish themselves in shelters, many will escape by creeping away or sheltering in the disturbed surface, which otherwise would have been destroyed by winter operations. If the bushes are properly pruned and all hanging leaves cleared, and likewise the surface-soil with the fallen leaves upon it scraped off, and either carried quite away or so treated that the caterpillars in it will be destroyed, the plan will answer as well to check repetition of the attack next spring as it does with that of Gooseberry Sawfly caterpillar. The pests being absolutely cleared out from under the bushes, there is nothing to come up in any stage of life.

All the measures of handpicking, shaking down, and destroying the caterpillars under the bushes, dusting with various applications, dressing under the bushes in winter or early spring with lime or gaslime, &c., which are found serviceable in checking the attack of Gooseberry Sawfly caterpillar, and of which an abstract was given from previous Reports in that for 1884, pp. 40-43, would be equally serviceable in lessening damage from Magpie caterpillars, which are easily kept in check by moderate care.

HOP.

Aphis Harvest Mite. Section of *Trombidiidæ* (? species).

The large amount of communication forwarded and reported regarding Hop Aphis during 1883 and 1884 make it unnecessary to add anything further at present regarding Hop Fly or Lice themselves,* but it is desirable to draw attention to a red "mite" having been noticed by various observers in the act of eating the Hop Lice.

On July 28th the following notice of this red spider-like mite was inserted in the 'Brewers' Guardian':— "A red spider, somewhat larger than the well-known 'money-spinner,' has been noticed running over the Hop-bines and leaves; it is found that it carries off lice in its mouth, and quickly devours them. We have seen them in previous years, but never in such numbers as this. They must not be confounded with the 'Red Spider' proper."

Specimens of this *Acarus*, or mite, were forwarded to me on July 31st from Barming, near Maidstone, by Mr. C. Whitehead, with the note:—"I send you some spiders which eat lice (*Aphis Humuli*). They are very plentiful, and have only this year been known to be Aphis destroyers. I cannot find any web. They run very fast over the under leaves of the Hop-plants"; and on Aug. 14th Mr. Whitehead again noticed the mites as very numerous.

On examination these small red creatures proved to belong to the family of "Harvest Mites," *Trombidiidæ*, many of which are known to feed on insects or insect allies. Two kinds feed, in the United States, respectively on locusts and locust-eggs, and another on the Rose Aphis. With us one kind is often seen attached to the long-legged Harvest Spider, and I find a notice of another, the *Trombidium aurantiacum*, as follows:—"A squat orange-coloured mite, of which the perfect form is not known with certainty, but it has been supposed to be a species described by DeGeer under the name of *Trombidium aphidis*, which feeds on the black Aphis which is so abundant in beans, poppies, and other plants."

In the absence of fresh specimens, and likewise of full descriptions to compare them with, it has not been possible (though I have had the benefit of consulting with skilled arachnologists), to make out the

* As the communications received have mainly turned on points already entered on at length, I have thought it better not to repeat the information, but to reserve remarks until further definite observations have been given; and I must mention with much regret that the special experiments which were again in progress at Stoke Edith Park, near Hereford, on the ground kindly given up by Lady Emily Foley for this purpose, were stopped for the season by the illness of the observer, Mr. Arthur Ward.

specific name with certainty; but we know enough for present purposes in making it out as a "Harvest Mite."

These "Harvest Mites" (*Trombidiidæ*), and the "Spinning Mites," commonly known as "Red Spiders" of the Hop (*Tetranych*), are sections of the order *Acarina*, or mites, which are distinguishable from true spiders by the mites never having the abdomen joined by a kind of stalk or mere small point of attachment to the fore body. The body is, so to say, all in one piece.

Waiting a fuller description, we can perhaps hardly improve for general service on the one given from the 'Brewers' Guardian,' as it resembles nothing so much when seen on the plant as "a red spider, somewhat larger than the well-known 'money-spinner.'" Observations next year would be desirable, as, looking at the way in which various kinds of mites congregate where not wished for, we might find out what attracts them, and act on the knowledge; and meanwhile, as a name of some kind is needed, and the creature is a "Harvest Mite" and eats Aphides, I would suggest that the name of "Aphis Harvest Mite," or "Aphis-Mite," would be both correct and convenient.

M A N G O L D.

Mangold Aphis. ? *Aphis papaveris*, Fab.; ? *A. atriplicis*, Linn.
(Turnip Aphis, Green Fly, *Aphis rapæ*, Curtis; Cabbage Aphis,
White Lice, *Aphis brassicæ*, Linn.)

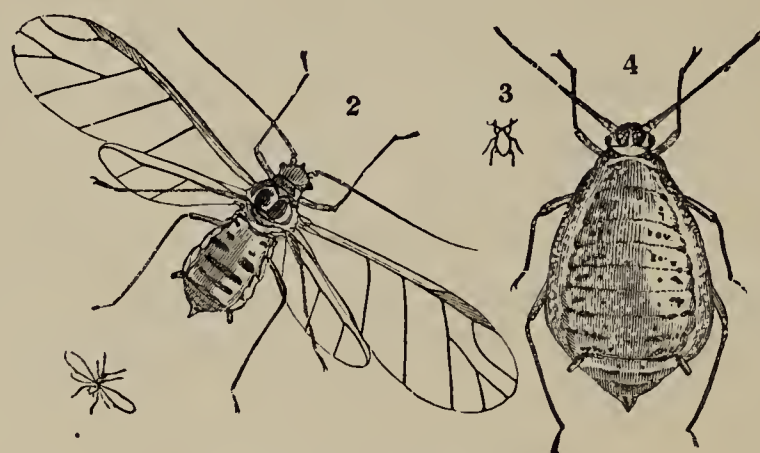
Generally speaking, it saves much trouble in referring to farm insect attacks to class them under the name of the plants they damage; but during the past season of 1885, in which, in consequence of the drought, Aphis-attack affected most of the common crops to an unusual extent, these attacks were occasionally reported so completely in connection that it is impossible to separate them. This was the case with damage to Mangolds and Turnips, both of which crops were reported as in some instances suffering seriously.

On the 29th of July specimens of Mangold and of Turnip leaves infested by plant-lice were forwarded by Mr. Martin Burt from Elsenham, near Bishop's Stortford, with the mention that he had no doubt that they were attacking the plants in consequence of their growth being checked by the drought, which was then prevalent.

Mr. T. H. Hart, writing from Park Farm, Kingsnorth, Kent, relatively to attack of Aphides on root-crops, remarked:—"Mangolds, if let alone, had quite enough to do during the drought to maintain themselves. Nevertheless, every tenth or twelfth plant had a host of

rather dark, powdery Aphides beneath the curled leaves, some of which still remained on Sept. 26th, and perhaps later. Such Swedes as found sufficient moisture to grow were also attacked by Dolphin, and severely checked. In favoured localities there would have been some very fair pieces of Swedes but for this pest."

Prof. P. McConnell, writing during October from Ongar, Essex, remarked:—"You are, of course, aware that all over the country there has been, this year, almost a visitation of 'Green Flies' (Aphides), and that scarcely any crop has escaped their ravages. . . . I estimate our own loss on Turnips and Cabbages, from the *Aphis*



APHIS BRASSICÆ, Linn.

Cabbage Aphis. 1 and 2, male Aphis; 3 and 4, female (nat. size and mag.).

brassicæ, at £3 per acre. Of course, the dry season is primarily to blame for their damages to roots, but, as the leaves were swarming with the grey powdered variety, they are responsible for the above damage.

"One very noticeable fact is the attack on the Mangold plant. I had occasion to examine our crops narrowly for these attacks, and noticed that the shoots of Mangolds which had run to seed were covered with black Aphides."

Prof. McConnell further drew attention to considerations as to these black plant-lice being the same kind as the Bean Aphis, commonly known as "Colliers," and stated that he considered the "black fellows" were the larval form of *A. fabæ* of Curtis, but that he could not find a single adult specimen."

Communications were sent from other quarters relatively to black plant-lice, considered by the observers to be "Colliers," being found on Mangold leafage; and, through the courtesy of the Editor of the 'Farmers' Gazette,' Dublin, some specimens were sent me, but without at all venturing to form an opinion what the others might be which I did not see, those forwarded certainly did not correspond with the received descriptions of the "Colliers"—that is, of the *Aphis rumicis*, Linn., the black Bean Aphis, which we all know well as appearing first near the tops of the Bean-stalks at flowering time.

This Bean Aphis infests many plants, but I have not found it recorded as a Mangold pest; whilst another kind, the *Aphis papaveris*, bearing such a strong resemblance to it that it does not seem clear how far it has at times passed under the same scientific names, is known to frequent Mangolds. There is yet another kind, the *A. atriplicis*, which frequents Orache or plants allied to Mangolds, and of which some varieties in their early stage are exceedingly like the corresponding stages of "Collier."

The full description, and much information regarding these, will be found in 'British Aphides,' vol. ii.; but, as it is of considerable importance to make out what kind of black Aphis it is that attacks the Mangolds, I give a short note of some of the chief distinctions between these three very similar species taken from the above source.*

Aphis rumicis, Linn. "Collier." — Wingless viviparous female: Black; three middle joints of horns, and also the shanks, obscurely ochreous. Winged viviparous female: Black, or sometimes slightly rusty brown. Larvæ (lice), slaty grey; afterwards velvety black. Pupæ (next stage, when they have wing-cases), fore body slaty grey; abdomen black, with white spots on each side.

Aphis papaveris, Fab.—Wingless viviparous female: Nearly black to the naked eye; horns and legs very pale greenish, almost white. Winged viviparous female: Fore body black; abdomen olive-green, with some obscure bands, and dark side spots. Larvæ at first pale green. Pupæ (quoting from the only place in which I am aware of their being described), spotted with white on the back.

Aphis atriplicis, Linn. — Winged viviparous female: Dark olive; abdomen very large, obscurely barred with black; sides spotted. "Larvæ of all shades from green through olive to black." It is not clear from the disposition of one paragraph whether a wholly black variety, and a black variety spotted with downy white patches on the abdomen, are larvæ, or wingless viviparous females. Pupæ: Fore body olive; abdomen black, with white patches."

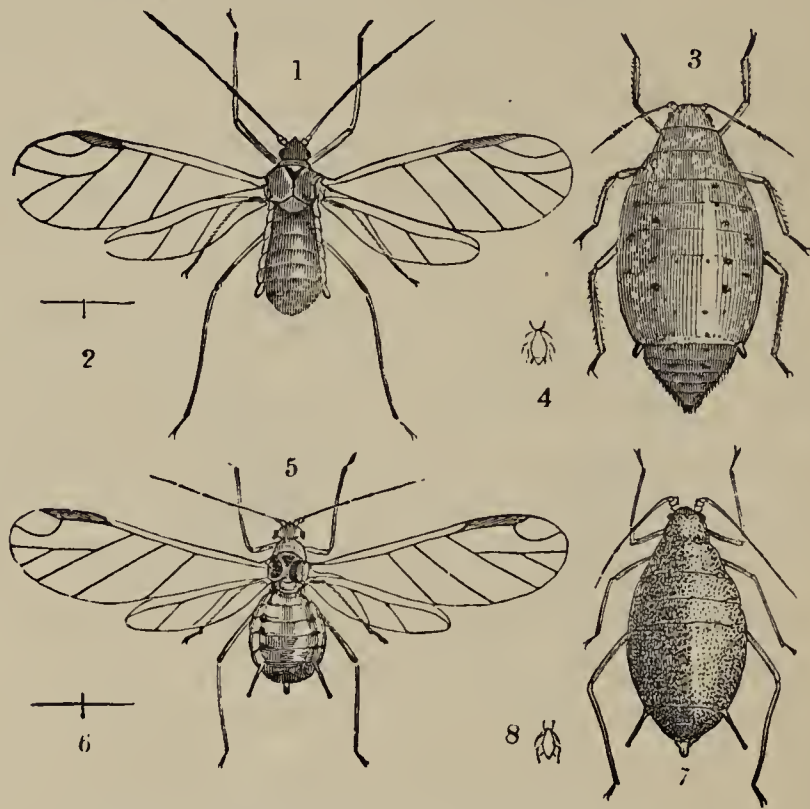
It will be seen from the above descriptions how difficult it is to make sure of what kind it is that is doing the damage, especially if only specimens in an early stage, when it may chance some of those of any kind of the above, black spotted with white, were present. Therefore, it does not appear sure that it is our regularly present Bean Aphis which was attacking the Mangold; and, as the attack was noticed as unusual, it may be hoped it will not occur again, unless under such peculiarly favourable circumstances for Aphis-attack as those of last year.

There does not appear to be any way of checking the attack on the

* 'British Aphides,' by G. B. Buckton, F.R.S., vol. ii.

leafage, but, where the black Aphides were settled on stems which were running up to seed, it would save increase of the pest to clear these off and destroy them.

The common Turnip and Cabbage Aphides, noticed above as prevalent, together with those on the Mangolds, are too well known to need



APHIS RAPÆ and *A. FLORIS-RAPÆ* (Curtis).

1—4, Turnip-flower Aphis ; 5—8, Turnip Aphis ; nat. size and mag.).

description ; and on the scale of field cultivation, where large areas are attacked in consequence of drought keeping back the plants, and being favourable to increase of the plant-lice, there does not seem at present to be any artificial remedy. In gardens something may readily be done by using measures to keep up a good growth, and by applying washes with the syringe or garden-engine to clear the lice. Water or mere fluid will run off from their repellent coats, but if a basis of soft-soap is given so as to make the wash adhere, whatever Aphis-poison is preferred, such as quassia, paraffin, or any other deterrent, may be used with good effect.

I have myself found the soft-soap and paraffin wash, brought forward in my Report for 1884,* answer well. The powdery coat was

* As the recipe is the most simple and the surest that I am acquainted with, I repeat the description from last year's Report :—

The proportions and plan of mixing were worked into this practical form by the late Mr. Alex. Shearer, while at Yester, Haddingtonshire, who was a clever chemist as well as an able and intelligent gardener. The method has now been tried for some years, and found safe as well as serviceable, and is in regular use, under the superintendence of Mr. Malcolm Dunn, in the Gardens of the Duke of Buccleuch at Dalkeith Palace :—“To eight parts of soft water add one part of black (soft) soap, and boil briskly for a few minutes until the soap is thoroughly dissolved. While

at once removed by it from the Aphides, and the creatures killed, the plants thus getting a few days' rest before a new attack was set up,

boiling add paraffin, or any similar mineral oil, and boil for a minute or two longer, when the whole will be thoroughly amalgamated, and, if bottled and securely corked while warm, it will remain so, and be fit for use at any time when required. The strength of the solution of course depends on the amount of mineral oil in it, and it can be easily reduced to the proper power by mixing it with soft water as it is wanted for use."

Mr. Malcolm Dunn gives me the following notes as to the method he finds most convenient for mixing the application:—"In practice I boil the proper proportions of soap and water together, and when ready I fill this into ordinary wine-bottles, which have been placed in boiling water. The bottles are about half-filled with the lye, and then the paraffin is poured into them, *two gills* being put into each bottle. The bottles are then filled up with the boiling lye, corked at once, and stored away for use.

"When required for use a bottle of the mixture is poured into a four-gallon watering-pot, which is filled up with soft water, and is ready for use, at a strength of one wine-glass of paraffin (*half a gill*) to one gallon of water."

Mr. Dunn further notes that the important point is the proportion of the soap and water:—"Eight parts water and one part soft-soap thoroughly amalgamated form the lye which takes mineral oil, and thoroughly amalgamates with whatever proportion of this may be added,—that is to say, the paraffin may be put into the boiling soap and water in any quantity, and the whole will mix together of an equal strength throughout. Heat helps much in quickly producing thorough amalgamation of all the ingredients, and hence I have stated that they should be mixed in a *boiling state*.

"My object in using common wine-bottles for mixing the lye and paraffin is, for one thing, they cost me nothing, and the cost is not heavy in any case; but further, by having two gills (four wine-glasses) of paraffin in each bottle the men can make no mistake in using it at the proper strength. By using one bottle of the mixture (containing four wine-glasses of paraffin) in an ordinary four-gallon can, the mixture is at the rate of one wine-glass of paraffin to a gallon of water, and so on.

"Few plants in a *green state* will stand a strength of four wine-glasses (two gills) to the gallon, but at the same time it is not necessary to use it so strong for even *Scale insects*, the most difficult to kill of all ordinary plant-pests.

"One wine-glass full of paraffin to a gallon of water is strong enough to kill Aphides, and such soft insects; two wine-glasses for Thrips, and three wine-glasses for Scale is our 'regulation' strength. The tender young fronds of ferns and the *young green growths of most plants will not be safe if over one wine-glass to the gallon is used*.

"This mixture is such a safe, cheap, and easily applied remedy for insect-attack that a knowledge of it must prove a boon to many who have their crops annually destroyed by insects."

The above recipe, which has now been in use with success for some years, will probably be of service for a large number of attacks on bush-fruit trees (as for Gooseberry caterpillars, &c.), and (at least in garden cultivation) for Aphides on Cabbage, Carrots, Turnips, &c.; but I place it under the heading of Mangolds, as this is one of the regular field-crops to which paraffin solution has been successfully applied in the case of leaf-maggot, and would have been more used but for the difficulty of keeping the paraffin permanently mixed.—'Eighth Report on Injurious Insects,' by Editor, pp. 66, 67.

which, in garden cultivation, could be again got rid of without much trouble.

The Aphis-feeding insects followed in the train of the Aphides on Turnips, as well as on other crops, for on Aug. 2nd a specimen was forwarded from the neighbourhood of Taunton, of a "kind of crawling or running insect," which had that day appeared in great numbers on Swedes, which proved to be the grey and orange (or yellow and scarlet) spotted grub of the Ladybird Beetle; and on Sept. 3rd I was favoured, by Mrs. Marshall, of Poulton Priory, near Fairford, with a note of



Ladybirds. -1, leaf with chrysalis; 3, 4, grub (mag., with nat. size); 7, *Coccinella bipunctata*; 8, *C. dispar*; 9, *C. septempunctata*.

great numbers of Ladybird chrysalids having been observed in a field of Swedes. The chrysalids are black, with orange spots.

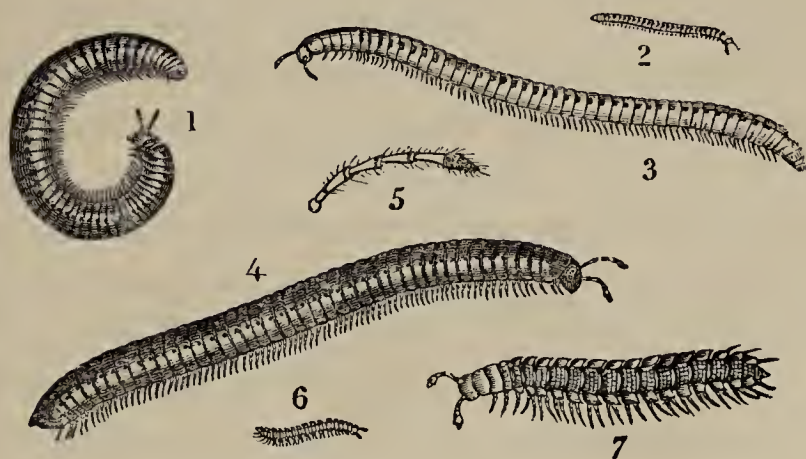
Later in the year, on September 16th, specimens were sent from Edinburgh, of which an enormous proportion had been destroyed by Parasite Flies. The *Aphidius rapæ*, Curtis, (nearly allied to the *Aphidius avenæ*, or Corn Aphis Ichneumon Fly, figured at p. 14) is one of the natural destroyers of Turnip Aphides. The Turnip Ichneumon lays an egg in one Aphis after another, and the maggots feed within, and thus destroy a large amount of the pests.

Millepedes; "Thousand Legs"; False Wireworms; Julius Worms. *Julidæ*; *Polydesmus*.

The amount of injury to field-crops which is caused by various kinds of Millepedes, or "Thousand Legs," commonly known as Julius Worms or False Wireworms, is year by year either increasing or becoming much more observed, and, as in this case we are dealing with pests which never acquire wings in any stage of their lives, something might quite certainly be done either to destroy them in infested land whilst it is empty of crop, or to prevent them being brought on to it in manure. What could be done to prevent them

transferring themselves by migration is a further question, as I am not aware of this habit having been noticed previous to the observation communicated in the present report.

Some remarks on Millepedes, and the injury caused by them, have been given in previous Reports; but, as the damage appears to be on



JULIDÆ; POLYDESMUS.

1, *Julus Londinensis*; 3, *J. guttatus* (*pulchellus*, Leach); 4, *J. terrestris*; 5, horn; 7, *Polydesmus complanatus*; all magnified; and 2, *J. guttatus*; 6, *P. complanatus*, nat. size.

the increase, a fuller description of the kinds most commonly met with may be desirable.

Julus Worms, Snake Millepedes, or False Wireworms, as they are sometimes called, are not true insects, as they do not go through three different distinct stages, and never have wings; but, from the great amount of damage they cause, they may well be classed amongst crop-injurers.

The *Julus guttatus*, or “Spotted Millepede,” figured above, is one of the commonest and smallest kinds, and is easily known by its pale greyish colour, and by having a row of crimson spots along each side, excepting near the tail. Occasionally some of the spots are absent. After death this kind often changes to a deep crimson or purplish colour.

Two other common kinds are the *J. Londinensis* (at one time especially found infesting Wheat in Surrey), and the *J. terrestris*. The latter is one of the largest of the British species, and is an inch or more in length, pitchy in colour, with ochrey legs, and is distinguishable from the “London” Millepede by having the segment next the tail ended above with a spike or long point, whereas the same segment in the *Londinensis* is nearly round, and this species is of a dark leaden colour, with whiter legs than the *J. terrestris*.

There are several other British kinds, one of which (the “Dotted” Snake Millepede, *Julus punctatus*, Leach), is about an inch long, and of a pale flesh-colour, with black dots along the sides; another kind, the Broad-lined Snake Millepede, *Julus latestriatus*, Curtis, only about

half an inch long, is of an "ochreous-purple," with a row of dots along each side; and yet another, the Hairy Snake Millepede, *Julus pilosus* of Newport's MSS., is a slender, somewhat lead-coloured, Millepede, and distinguishable by the fine downy coat, from which it takes its name.

These various kinds are much alike in their life-history. The females are stated to lay their eggs from about Christmas-time until the middle of spring. The young Millepedes, when first hatched, have not more than three pairs of legs, but whether they are hatched with these, or hatched legless, and gain them at the first moult, does not appear certain as yet; with the successive moults or changes of skin they gain additional numbers of segments, and of pairs of legs, sometimes as many as eighty or more. In *J. Londinensis* about 160 legs is stated to be the full number, these being so arranged that each segment appears to have two pairs of the little claw-like legs beneath it.

The Snake Millepedes live for two years before reaching full growth and power of reproduction, and during this time change their coats several times, but continue throughout their lives to have their somewhat worm-like shape.

The Flattened Millepede, *Polydesmus complanatus* (figs. 6, 7), has the same method of growth and habits as the Snake Millepedes, and is also very injurious; it may be distinguished by its upper side being flattened.

Amongst the various kinds, the *Julus guttatus*, the first of those described and figured at p. 45, is one of the most destructive, and is especially fond of Mangolds. The following observations, sent to him by his bailiff, together with specimens of this Millepede, were forwarded to me, on May 29th, by Mr. T. Pain, Member of Council of the Royal Agricultural Society, regarding bad attack to young Mangolds on his land at Audley's Wood, Basingstoke, Hants:—

"In the enclosed soil, which I took from the Mangold field this morning, you will find a great quantity of little worms, or insects which devour all the plants as fast as the seed germinates; they are as thick in proportion as the enclosed in every drill all over the field."

Mr. Pain mentioned that the Mangold seed was drilled with ground rape-cake and Purser's Mangold manure, 3 cwt. of each, and no farm-yard manure had been applied to the land since the previous year, and, as usual, 5 cwt. of salt per acre was applied before sowing. Mangolds "had been *grown very* successfully for four years on the same ground."

In the previous year ten tons of manure to the acre were put on the same ground, carted straight from covered sheds, the manure being from pigs fatted on barley-meal; cows fed on decorticated cotton-cake, maize, and bean-meal, or dari crushed with Mangold;

also manure from cart-stable. The land is a good deep loam on chalk, ploughed after Mangold-crop lifted, and deeply ploughed, left in fallow all winter, and had no farm-yard manure this year.

Specimens of the artificial manures used were forwarded, and on examination appeared quite clean from attack.*

In experiment with the specimens of *Julus* worms sent I found that salt and water destroyed them in a very short time; and the following note from Mr. Pain's bailiff shows (what is of considerable interest) that the salt must be diluted to do any good in killing the pests. The communication was as follows:—

“After receipt of your letter I went to the field when raining (pouring), and got about two pounds of the soil with the insects in, and added a tablespoonful of salt to one pound and the same quantity of nitrate of soda to the other pound: *in two hours time the insects were still alive.* I afterwards added a *little water*, and they were all dead in both cases in five minutes (just as Miss Ormerod said), but previous to my adding the water there was sufficient moisture in the soil to dissolve both the salt and nitrate of soda. Therefore, I think a *brine* of salt and water would be more effective, and put on with as little labour as dibbling the salt up the drills.

“I feel almost convinced their origin must be in the manure, as we find them in bunches now and then round a bit of *bone or refuse* used in the manufacture of the manure; still they have a great liking for the Wurzel, as I have proved to-day. Upon searching I found the most of them deeper in the soil than I found them on Tuesday; I concluded this was owing to the rain, but I soon discovered it was in search of food.

“Before drilling the seed I soaked half of it for forty-eight hours, and, when sufficiently dry, mixed it with the unsoaked seed, and drilled together. The soaked seed germinated in five or six days, and furnished food for these insects [Millepedes, Ed.] close to the surface; this they have devoured, and now they have attacked the unsoaked seed just germinating, as we find a bunch of from five to twenty round every seed. This accounts for their being deeper in the soil in this instance.”

On the 25th of June, Mr. Edm. Riley, of Kipling Cote, Market Weighton, noticed something gone wrong with about an acre of Mangolds in the corner of a fifty-acre field; this piece in the field, which was Barley the year before, had then been remarked as not doing well, a good deal of it having died away, as if from Wireworm-attack. “In this case, from the condition of the specimens, I could

* It was, however, somewhat singular that the young sprouting Scarlet-runner Beans, to which I applied this manure in my garden, failed almost entirely, though I could not detect Millepedes among them.

not be certain they were of the 'Spotted Millepede,' *J. guttatus*, but they appeared to be so from the description"; and Mr. Riley further observed:—"I think there is no doubt that it is the Millepede you mention, as it quite agrees with the description given by Curtis in 'Farm Insects.'"

"The Wurzel is completely eaten round within the ground, and then, of course, dies."

In this case heavy rain set in the day after the specimens were sent, and continued for some days, and, with the favourable weather, the plants grew past attack, so that only from about a third to half of the acre attacked was ultimately destroyed. Relatively to manure, it was noticed:—"They cannot have been in the manure, as the other part is free: all done with the same. Besides fold-yard manure they had a dressing of 3 cwt. of kainite, also $1\frac{1}{2}$ cwt. of rape-cake, and $1\frac{1}{2}$ cwt. of superphosphate."

The following communication, with which I was favoured by Mr. J. A. Smith, of Rise Hall, Fakenham, is of much interest, as being a note from his own personal observation of the migration of another common kind of Millepede in large numbers from one locality to another. On the 31st of May, Mr. Smith forwarded me specimens agreeing with the common pitchy coloured *Julus terrestris*—the Earth Millepede, figured at p. 45—in appearance, but of remarkably large size, with the remark that "it was an injurious insect well known to us farmers"; and further mentioned:—"A few mornings since a turnpike-road in this neighbourhood was covered with these creatures, apparently travelling across from a field of Oats towards a piece of pasture-land. These Oats are in succession to Turnips fed off late; both crops were a partial failure perhaps from insect ravages.

"From the general direction of the insects' travels across the road, I conclude that, the Oats having grown out of their way, they made tracks for a pasture on the other side of the highway. The simultaneous movement of many of these creatures was to me a new and surprising circumstance."

On special inquiry Mr. Smith mentioned that he noticed the Millepedes as being of different sizes as they swarmed across the road; "indeed, on that morning they crowded in such numbers that I crushed them under my feet, till I shuddered at the cracking noise." This mention of the cracking noise is especially noteworthy, as the hard coats of these Millepedes distinguish them clearly from the common field caterpillars.

The Oat field which the Millepedes appeared to be leaving had been in Wheat the previous year, followed by a "catch-crop" of Turnips; and it is further mentioned that the occupier of this land, which is not in Mr. J. A. Smith's hand, carted annually a quantity of

town manure containing slaughter-house refuse, and what I may perhaps best describe as garbage, some of which accumulations would be very suitable for Millepedes.

The following note refers to sudden appearance of Millepede-attack, on a much smaller scale than the above, but which seems only to be accounted for by migration, for, as these pests eat from their earliest condition, their presence would not become observable *suddenly* unless they transferred themselves (or were artificially transferred in manure, which in this case there is no mention of), from one place to another.

In the course of July I received an inquiry from Mr. Spencer Smithson, of Facit, Rochdale, as to how to get rid of a pest of Millepedes in garden ground, which had "completely destroyed one bed of pansies by eating the roots, and were then just beginning to attack another." On inquiry as to whether the creatures could have migrated, it was replied that from the position of the beds it appeared very improbable that the Millepedes had travelled from one to the other; but in both cases the attack had been very sudden, as if the pest had just arrived. There were many specimens of the black-grey kinds, but the kind which caused most damage was "much like *Julus guttatus*, only considerably longer."

An application of soot and water was tried, mixed in the proportion of two handfuls of soot to one gallon of water, applied as closely as possible to the crown of the root by means of a watering-can with a long spout and no rose. This was reported as very successful; whether it acted by killing the Millepedes or driving them away was not ascertained; conjecturally it was in both ways, as, though the mixture acted very well on the whole, some of the Millepedes were seen to come out of the ground when the soot and water was applied to one of the roots, and after a while a few more roots were attacked.

The following note, sent by Mr. P. Sharp, on the 20th of August, from The Gardens, Claydon Park, Winslow, Bucks, shows the damage caused by various kinds in garden cultivation:—

"Herewith I send you some Snake Millepedes, I think of several kinds. With us they are most numerous this season, completely destroying all succession crops of Peas and French Beans in this locality. I have applied doses of lime, soot, paraffin, &c., but with no avail."

The specimens forwarded were of the Flattened Millepede, *Polysdesmus complanatus* (see figs. 6, 7, p. 45), and of the long yellow thread-like centipede* often found in turning over decayed leaves, or beneath stones.

* This centipede (*Geophilus*) may be easily known from the Millepedes by its long narrow shape, like a piece of stout flattened silken thread about a couple of inches long, of a yellow or ochreous colour, and furnished with fifty or

From reports sent in during the last three years it appears that the Millepedes live on most of our common root-crops, such as Mangolds, Potatoes, Carrots, Onions, &c.; likewise on young Wheat, and on various crops, on which they feed, as the case may be—at the roots, as of Peas; or at what they can reach, as Celery; or on ground-fruit, as Strawberries. The fact of their feeding on Wheat was observed more than forty years ago in the case of the *Julus Londinensis*, and, without entering at too great length on details, everything confirms the fact that they are general feeders, consuming living and decayed vegetable and animal substances.

The females are stated to lay their eggs in the ground from about the end of December until the following May, and to propagate most in undisturbed ground; but the Millepedes are to be found under rubbish, or amongst dead leaves, or especially in manure-heaps where much refuse garden rubbish is thrown.

Looking to the good effect of salt and water in killing them, it would appear that lightly stirring the surface of land which was infested in the previous year, and giving it as heavy a dressing of salt as it would bear during the winter, would be a very good remedy. If this was applied after Christmas, the brine or dilute salt would almost certainly kill all the young hatching Millepedes and a large proportion of the old ones, and at that time of year they would not be likely to be able to get out of harm's way by migration. This point (of migration), which I believe has been first noticed by Mr. J. A. Smith, of Rise Hall (already mentioned), is an extremely important one, and may account for much previously quite unaccountable appearance.

The Millepedes live for two years before arriving at full growth, or power of reproduction; consequently, when a sudden devastation is set on foot, it may be presumed they have suddenly arrived, as, if present previously, they could not have failed to have been feeding up to the date of observation, and there is no sudden change in these powers. Sometimes they are brought on the land in manure, and this is especially the case in gardens, where the refuse they delight in is wheeled out on the ground. Thorough inspection of such heaps, and the requisite treatment, such as dressing the manure with

more pairs of legs, arranged one pair on each segment. Its habit of twisting in all directions is another distinguishing mark. It feeds on vegetable matter, fresh or decayed, and is likewise considered to feed on animal matter, such as insects, or the like. It is stated to be a night-feeder, and sometimes leaves a phosphorescent trail where it has passed. I have not given the specific name, as there appears some uncertainty whether the *Geophilus longicornis* (Leach), of which the description is given above, is a different species from the *G. subterraneus*, or whether these are both of them the same as the *Scolopendra electrica* of Linnæus.

caustic-lime or gas-lime (with due care), or salt, would be the proper remedy.

Cotton-cake has been found to attract them from the attacked crops, and the overwhelming fondness of the Pink-spotted Millepede (*J. guttatus*) for Mangolds may be turned to account, in attacks on special crops, by placing slices of Mangolds for traps, which I have seen swarming (when removed) with the Millepedes crawling over them in all directions.

Night-feeding Ground Beetle. *Steropus madidus*, Fab.



STEROPUS MADIDUS.

Ground Beetle. Mangold-roots eaten by the same.

The following observation is of somewhat special interest, on account of the beetle to which it refers being one of the Ground Beetles, a section which, until a few years ago, was supposed to live almost entirely on animal food, such as worms, grubs, maggots, and the like, and therefore were thought helpful in keeping down insect vermin; and this special kind, the *Steropus madidus*, was known as preying by night or at dawn.

During the last few years, however, various kinds of these *Geodephaga*, or Ground Beetles, have been found to feed on vegetable food, including rootlets, seeds, or other parts of grass and corn; and on June 29th the following note of careful observation of the attack of the *Steropus* on Mangolds was forwarded to me from The Grange, Bishops Stortford, Herts, by Mr. T. James Mann, with specimens of the beetles accompanying. Mr. Mann wrote as follows:—

“I send you two beetles, which were found at 3 a.m. this morning eating my Mangolds on this farm. I am sorry to say I have lost a good many plants. The soil was manured with ten loads farm-yard manure, 4 cwts. superphosphate, and 2 cwts. of salt.”

A little later on more of the beetles were forwarded which had been caught also early in the morning in act of eating Mangolds, together with

specimens of the injured roots, "good types of how they were eaten off." Two of these are figured, and it will be observed that the workings are very peculiar; in both cases the damage had obviously been done by some pest with powerful jaws, and in one root especially the jagged edges of the scoops showed very plainly where the substances had been torn away in a manner differing from any other method of attack that I am acquainted with. A large sketch was also forwarded, showing the method of attack to roots grown to as much as about five to six inches in length, and an inch and a quarter to an inch and a half in diameter at the top. The injury was just at the ground-level, sometimes all round what may be termed the shoulders of the root, sometimes only on one side or in patches, and these patches were represented in the drawings sent as gnawed in a very similar manner to the method of injury given at p. 51. The injured patches were figured as extending a very little below the ground-line, but were chiefly above it. The beetles did not eat the leaves, and the damage was noticed as being done in the very early morning, or, in fact, done almost in the night; in one instance three beetles were found at one root. The Mangold died of the injury as the sun came on it.

With regard to amount of injury caused by the beetles, Mr. Mann mentioned:—"As near as I can form an opinion they have had about one plant in every ten. A neighbour of mine has had the same loss, but he has not caught any. The fact is, it is night-work. In one part of the field the beetles took one in every five."

The figure on p. 51 precisely conveys the shape of the beetles sent. The line gives the true length. The general colour is shining black, with the legs often of a red tint. The jaws are large and curved, legs strong, and wings absent, which last is an important point to observe, as the fact of the beetle being wingless limits the area of its attacks greatly.

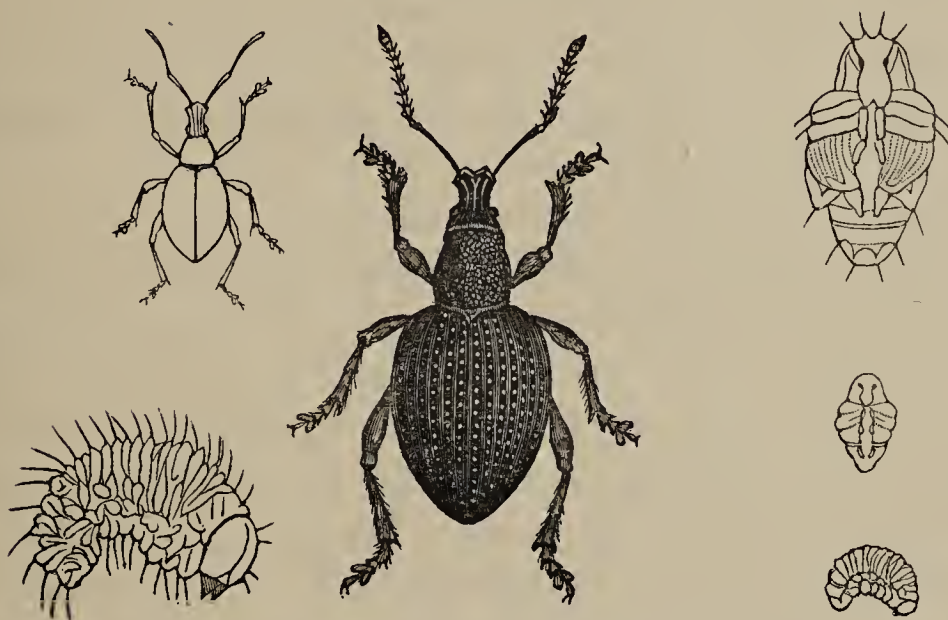
Previous observations have shown the beetle to be a night-feeder (already mentioned), and in captivity it is carnivorous to a certain extent, for one of those sent me alive killed its companion and cleared out the contents. This, however, no way militates against the beetle feeding on vegetable food when free, as regular vegetable feeders, such as the caterpillars of the Common Turnip Moth, will, as I have myself seen many times in the last season, kill each other, and suck up all that is available, leaving only the horny head and other hard pieces.

The transformations—that is to say, the early stages which this beetle passes through—do not appear to be known; but, from observations made by Prof. Westwood in 1854, it appears to be almost certain that the larva is a narrow fleshy grub, about three-quarters of

an inch long, with a scaly head, furnished with sharp curved jaws, three pairs of jointed legs, and a pair of long somewhat bristly processes at the tail.

Whether this attack will prove to be one of those which are regularly troublesome remains to be seen; peculiar circumstances, as of drought or otherwise, may have caused the beetles to attack the roots; but any way, it was well worth observing, as one more instance of the Ground Beetles, which were formerly supposed to be almost entirely carnivorous, by no means limiting themselves to preying on each other, or other insects. Also the gnawings are so peculiar that, whether on Mangold or on Potato, of which I have received similarly injured specimens, when observed they may lead to an enquiry at the earliest dawn of the summer's day for the cause of the mischief.

Night-Feeding Weevils. *Otiorhynchus sulcatus*, Fab. ;
O. picipes, Fab.



OTIORHYNCHUS NIGER.

Otiorhynchus niger (after Taschenberg); maggots and chrysalids of *O. picipes* (after Curtis); all life-size and greatly magnified.

The *Otiorhynchi* are a family of weevils of which some of the commonest kinds are remarkable for the enormous quantity of mischief they have a capacity of doing, whether (in beetle state) to leaves, shoots, or fruit above ground, or (as grubs) to the roots beneath the surface.

These weevils are of the shape figured, with a short stout rostrum or proboscis, and may be further known by having no wings; the colours run on black, grey, or clay-colour. The grubs are legless and fleshy, whitish in colour, with yellow heads, and of the shape figured, natural size and magnified.

Their method of life is for the egg to be laid a little below the surface of the ground; the maggots, which hatch from these eggs, may be found as early as August, and feed on roots, or they may be frozen hard without injury, if in their shelters under ground during the winter. Towards April they turn to chrysalids, from which the weevils soon come out.

On June 10th Mr. Warner wrote to me from the Nurseries, Leicester Abbey, regarding an attack of brown beetle-like insects, which appeared, as he said, to be "almost omnivorous," and, after giving a list of attacked plants, further noted, "*They are now materially injuring twelve acres of Mangel Wurzel.*" From the specimens accompanying these proved to be *Otiorhynchus sulcatus* and *O. picipes*, sometimes known as the Vine Weevil and Clay-coloured Vine Weevil, though they by no means confine their attacks to Vines.

It is a curious coincidence that this year three kinds of attacks to Mangolds are reported, in which the pests, whether insects or insect-allies, are wingless, and, excepting in such cases as they have migrated on to the land, it suggests the idea that they have come in manure. The Vine Weevil, the *Otiorhynchus sulcatus*, is especially to be found in Vine-borders, which, as we know, are largely formed of dung; and the Millepedes, as observed at page 47, were found clustering round pieces of bone in the manure, and possibly examination another year might throw some light on this circumstance.

With regard to the *Otiorhynchi* in the Mangolds, it is probable that the regular processes of farm cultivation will destroy any grubs in the ground, and thus prevent attack being continued on the same land next year. Where these or allied weevils establish themselves in vinery borders, in Strawberry beds, or in Raspberry plantations, where the surface cannot be thoroughly turned and disturbed so as to throw the grubs out, there is great difficulty in clearing them. The damage is sometimes very serious, as in 1878, when the loss in Raspberry plantations in Cornwall was estimated at many hundreds of pounds,—in one instance amounting to £100 on only two acres. But in open and empty land skimming the surface would turn the grubs out from their shelters to the action of the weather and to birds, and if a good salting or application of caustic-lime was added it would probably do all that was needed.

As the attack of *Otiorhynchus* weevils is one that is often enquired about, figures are given greatly magnified, as well as life-size, of the maggots and chrysalids of *O. picipes*, one of the common kinds mentioned above, and also of *O. niger*, of which the maggots feed at the roots of Pine and Larch.

MUSTARD.

Mustard Beetle ; "Black Jack." *Phædon betulæ*, Linn.



PHÆDON BETULÆ.

Mustard Beetle, nat. size and magnified.*

Attack of Mustard Beetle, commonly known as "Black Jack," has become such a frequent and serious evil, in the course of the last ten years or so, that it needs a thorough investigation.

The first observation (so far as I am aware) of remarkable appearance of this pest was in 1854, when Prof. Westwood, in reply to enquiry regarding beetles sent him for examination, stated:—"The little beetles which are attacking the White Mustard crops in the Fens, near Ely, are the *Chrysomela* (*Phædon*) *betulæ*. Such a fact has not previously been recorded."

Attack is mentioned as having been bad in that year, but not again till 1877, when they or an almost similar kind were reported from Wisbech (in the 'Chamber of Agriculture Journal'), as doing great harm to Mustard and other vegetables; and a grower of Coleseed near Littleport estimated his losses through the ravages of "Black Jack" at £1000.

In 1878, Mr. Marshall, of Ely (in a paper published in the 'Gardeners' Chronicle' for Sept. 14th), mentioned that the "Mustard Beetle" had again been doing much injury to the White Mustard, and other Brassicaceous crops, in the Fens at and near Ely, and notes that, though giving the preference to White Mustard, he had seen them that year on Turnips, Coleseed, and Kohl Rabi, and also on Charlock; likewise (which may be well worth bearing in mind) that

* The grub figured above by John Curtis was considered by him to be probably, but not quite certainly, that of the Mustard Beetle, figured accompanying. I should be greatly obliged if in the course of next season some of my correspondents would favour me with some grubs from Mustard under attack, so that we might secure a figure and description.

“it is curious to see in a field of Kohl Rabi (which it is the custom to grow here in the same field alternately with Mangel Wurzel), how completely they avoid the latter.”

In 1882, Mr. Caswell, of Peterborough, wrote to me* regarding a great pest in the shape of a beetle, called by the farmer the “Black Jack,” that infests the Fen district between Peterborough and Ely, especially round Whittlesea. They feed upon White and Brown Mustard plants, Cress, Rape, and Cole, and are so destructive that in six or seven days they will completely destroy a field of twelve acres, and leave nothing but the bare stalks. Mr. William C. Little, of Stag’s Holt, March, also writing to me on the same subject,† mentioned “that for some years past immense damage has been done by the Mustard Beetle to crops of White and Brown Mustard.”

In the present year, in a leading article on Foulness Island, in the ‘Agricultural Gazette’ of Oct. 5th, pp. 325, 326, it is mentioned:—
“The only paying crop at present is Mustard, which, after a year’s fallow and plenty of London dung, is not only productive itself, but the best possible preparation for the Wheat crop. But even Mustard is now threatened; it is being victimised by a little blue beetle, which attacks it green or dry, young or old, both as fly and grub, and threatens ruin to the crop.”

Communication was also sent to myself early in the summer by Mr. A. L. Harrington, who, writing on the 1st of May from Rochford, Essex, mentioned that he had been asked to obtain information as to the name and habits of a little blackish beetle enclosed, which was then clearing off whole fields of Mustard and other plants.

The Mustard Beetle is (as figured at p. 55, nat. size and magnified) short and oval in shape, and hardly as much as the sixth of an inch in length; legs, horns, and body beneath black, and above of variable tints of dark violet, blue, or greenish. Its life-history appears to be that the wintered beetles attack the Mustard, and presently lay their eggs, and in the natural course of things, after this, they die, and consequently disappear from the plants. Very soon the eggs hatch, the caterpillars (or grubs) spread themselves on the plants, devouring broadcast, and after a while they too vanish, but not like the parent beetles, because their term is ended, but because they have gone down into the ground to turn to chrysalids. They are stated to remain in this condition only fourteen days, and then from these chrysalids there comes up in full force the summer brood of beetles, carrying perfect devastation before it. Whether there is a second brood in England has not been reported; in Germany caterpillars have been found in May and June, and again in September.

* See ‘Report on Injurious Insects for 1882,’ Simpkin & Marshall. Published 1883.
† Ibid.

To get this pest within our power we want special observations from growers of Mustard, but there are some points in the life-history which certainly might be worked on as a basis of means of prevention. Mr. Harrington, in his letter regarding the attack last spring, remarked, "They were first noticed last autumn on Foulness Island, and *have kept quiet during the winter*, but are now causing serious alarm." This keeping quiet during the winter (like the Turnip Flea Beetle, which is nearly allied) helps us to keep them in check by not allowing them the requisite shelters to spend the winter in and come out from.

The Mustard Beetles hide at the roots of grass, or creep down pipes of reeds near ditches, or into hollow Mustard-stems, or *shelter in Mustard-straw*. In regard to this point, Mr. Little mentioned:—"Some years ago nearly all the Mustard-straw was burnt when the crop was threshed, which was generally in the autumn; but now a good deal is saved to make rough sheltering walls for cattle, and the cottagers beg a few loads and make use of it for covering their sheds or hovels."

Where Mustard is largely grown, the above point of the beetle sheltering itself in the rubbish of what may be called "its own crop" would be well worth seeing to. If the plan is still ever followed, which was in use some years ago, of separating the seed from the straw on the field, burning this straw in small heaps on the land would get rid of the shelter, and return much of the material otherwise carried off the field to the ground; or, if left at hand in one heap, it might act as a trap, and a large amount of pests be destroyed by firing it during the winter.

As the beetles especially frequent Charlock, also are found at the roots of grass, and go down pipes or reeds, &c., it would seem that they might be expected to infest neglected corn-stubbles, and that a crop of Mustard or Coleseed on the ground, or on ground adjacent to such localities, would be likely to suffer.

It is also open to consideration to what extent Mustard Beetles may be *sown along with the seed*. Mr. Caswell, in his notes sent to myself from Peterborough, mentioned:—"We have found the beetles alive in sacks of the seed for two years after it has been threshed." It would be very desirable to inspect seed before sowing relatively to this point, and, in case there should be any difficulty as to making sure of its condition, it would be my duty officially, as well as a pleasure personally, to examine any samples forwarded me as to amount of insect-presence.

It was observed in 1878, by Mr. Marshall, that the Mustard Beetles "*completely*" avoided *Mangolds*, even when the crop was alternated with Kohl Rabi in the same field. This might be turned to account in rotation.

Looking at the requirements of the Mustard plant in the way of preparation of the soil, kind of manures, &c., it would seem that a very large proportion of the measures of treatment advised by the many agriculturists who contributed information for the 'Report on Turnip Fly'* (which is in the hands of most of the readers of this paper), would be equally serviceable in the case of Mustard Beetle.

The benefit of all measures that will push on good growth is equally important to keep either crop up before anything but devastating attack, and in either case clearing the surface of the ground beforehand of all shelter for the pests is very important.

Amongst the various artificial manures noticed as good for Mustard, gypsum is mentioned as serviceable, by reason of containing the lime and sulphuric acid needed for proper formation of the seed. If these constituents could be applied in the shape of as strong a dressing of gas-lime as the grower considered safe to apply to the land, at the proper interval before the Mustard was put in, great benefit might be (so far as I can judge) hoped for. The gas-lime would be very beneficial in preventing the beetles taking up winter-quarters, and, with regard to amount, time of application before the land was resown, and other points as to *safe* and serviceable application of this chemical, see extracts from the paper 'On the use and application of Gas-lime' (by Dr. Augustus Voelcker), quoted at pp. 5, 6.

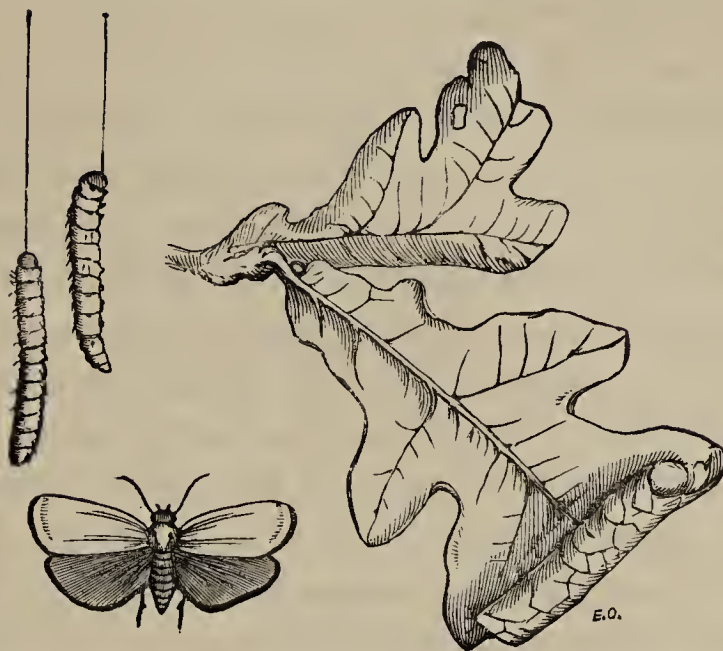
The habit of these Mustard Beetles of collecting in large numbers and sweeping regularly on suggests that something could be done to destroy them in the mass. Lighted straw in a field gateway is noted as serviceable when they are in migration from one field to another; and, looking at the point that they are noticed as not using their wings much at these times, the idea suggests itself whether a common wooden farm-roller, with liquid tar run over it by a man in attendance, might not be an effectual stop to these crowds, whether compressed in a gateway or advancing in long narrow line (as in another observation from life) across a field. If the roller and tar were found to act, it would be very easy to add a small and self-tarring apparatus to the roller.

But information is greatly needed how to check the attack generally. It is probable many Mustard growers are well informed both as to means of lessening the evil, and also of the circumstances which favour its increase; and, if they would kindly favour me with any notes on the subject for my next Report, it would be a truly serviceable contribution, which I should have great pleasure in bringing forward.

* 'Report on Turnip Fly during the year 1881,' Simpkin & Marshall. Published 1882.

O A K.

Oak Leaf-roller. *Tortrix viridana*, Stephens.



TORTRIX VIRIDANA.

Moth; caterpillars hanging by their threads, slightly larger than life; rolled oak-leaf.

The Oak leaf-rollers are small caterpillars which do injury sometimes over a great extent of woodland by feeding on the leafage of the Oak when young and tender, to such an extent as to strip the trees, and consequently greatly retard the year's growth.

The caterpillars hatch (at the time the Oak leaves begin to appear) from eggs which have been laid in the previous season. They are at first lead-colour or greenish grey. When full-grown they are about half an inch long, of a dull green, with dusky spots. They have the power of letting themselves down by silken threads, and may be seen in hundreds swinging in the air in infested trees, until they are either eaten by birds or return up their threads to the leafage. When full-fed—that is, towards the end of May—they turn to chrysalids either in tubes, which they have formed by rolling up the tip of the leaf and spinning it with threads into a kind of cylinder, or, if leafage fails them, to roll up or spin together, they wander away and turn to chrysalids in crannies of the bark of the trunks or boughs. From these chrysalids small moths of the shape figured above, with light green fore wings and hind wings of a brownish or silver-grey, come out about the end of June.

Mr. W. J. Allsebrook, writing early in the summer from Wollaton, Nottingham, mentioned that large numbers of the Oak trees in the surrounding woods were denuded of their foliage by severe attack of green leaf-rolling caterpillars. He noted further that the caterpillars produced very pretty green moths, and that the trees were full of

moths fluttering among the leaves in the evenings. From sketch of size forwarded and description these were caterpillars of the regular Leaf-roller Moth, the *Tortrix viridana*, figured on p. 59.

On June 23rd, by desire of Sir Harry Verney, of Claydon Park, Winslow, Bucks, a communication was forwarded to me by Mr. P. Sharp, the head gardener, mentioning that his fine old Oaks had been suffering from a severe attack of what was considered to be the Oak leaf-roller caterpillar. The caterpillars had stripped the foliage completely off one tree, and had fallen in great numbers to the base of the tree, where they became a putrid mass, of which a lump was sent to me.

The black decayed mass was formed of broken-up decayed caterpillars, of which the head and broken pieces disengaged themselves and floated up on the surface when the lump was washed in a large bowl of water. At the time that the specimens were forwarded the caterpillars had gone through their change to chrysalis, but, from examination of the bright green contents of these chrysalids, likewise from the method of attack to the leafage, and also from the minute detailed description of the caterpillar which I had the opportunity of receiving personally while examining the trees at Claydon from Mr. Sharp, it was not open to doubt that the attack was of the Oak leaf-roller.

The matter of the fall of the caterpillars from the tree is of considerable interest, as an example of the effects of sudden cold and wet in destroying these plant-vermin.

On June 27th, Mr. Sharp forwarded a table of maximum and minimum temperature at Claydon during the time when he observed the workings of the caterpillars:—

	Max.	Min.	Rain.
June 1	65°	42°	—
„ 2	74°	41°	—
„ 3	75°	45°	—
„ 4	83°	48°	—
„ 5	77°	56°	0·15 in.
„ 6	63°	53°	0·15 „
„ 7	68°	50°	0·05 „
„ 8	60°	54°	0·59 „
„ 9	64°	46°	—
„ 10	60°	44°	—
„ 11	67°	34°	—
„ 12	75°	45°	—
„ 13	76°	49°	—
„ 14	77°	49°	—

From this it will be observed that there was rainfall on four days after the max. temp. had risen to 83° in shade; but to continue in Mr. Sharp's own words:—“ It was on the morning of the 11th (of

June), when our night temperature had been at 34° , that I first observed the caterpillars falling off in large numbers."

This observation of moth-caterpillars being destroyed by sudden wet quite corresponds with what was noticed by Curtis in his 'Farm Insects' many years ago; and more recently by Mr. E. A. Fitch, Hon. Sec. of the Royal Entomological Society, on occasion of the great appearance of the *Plusia gamma*, the Silver-Y or Beet Moth, in Essex in 1879 (see my Report for that year, p. 5).

This peculiarity has not, so far as I know, been utilised as yet as a means of getting rid of caterpillar-attack, but, however it may be in field cultivation, it would be worth trying (where there is an available water supply laid on for garden use) whether good drenchings through a hose might not clear the obnoxious presence of caterpillars on Cabbage.

One of the trees attacked in Sir H. Verney's park being of especial value, on account both of its great age and size, it was wished to restore the foliage as soon as possible, and likewise to clean the tree from any remains of attack, and from other insects, as Aphides, &c., which might have remained. I therefore advised thoroughly washing down the tree by means of the house fire-engine, throwing the water, *not* broadcast amongst the boughs so as to tear or bruise any young leafage that was beginning to appear, but sending it directly at the trunk and large boughs. In this way the stream of water was thrown about in spray amongst the twigs, and thoroughly moistened every part, whilst the stream directed against the trunk cleaned out much of the insect-vermin that might be present. The ground beneath the tree was so well moistened as to help the coming growth greatly.

A few weeks after the experiment Mr. Sharp reported that:--
"Through the soaking which we gave the tree has recovered its foliage wonderfully. On all the parts on which we were able to play, the Aphides and all other insects, as far as I can discern, are cleared off, and I have no hesitation in saying that it is the right thing to do where trees are attacked, a fire-engine kept, and water at command."

On the 20th of August, Mr. Sharp further reported that it was wonderful to see how well the tree was then furnished with leaves.

One cannot always have the necessary amount of water nor engine-power at command; still, the above experiment may be of service in showing the benefit of applying measures to induce luxuriant growth; and in some cases like the above, where it is an object to preserve trees some centuries old from the results of devastating attack, the operations might be similarly carried out.

P E A.

Green Dolphin ; Pea Aphis. *Siphonophora pisi*, Kalt.

The Green Aphis, Dolphin, or Plant Louse of the Peas, is well known, as infesting the shoots of Peas in myriads in favourable seasons.

The following note of its prevalence at Kingsnorth, Kent, was forwarded by Mr. T. Hart, and is of interest, especially when taken in connection with his other notes on prevalence of Aphides on other crops in that district, and his observations of the deficient amount of rainfall extending over a period of twelve weeks from about the second week of June.

To give some idea of the amount of this it may be worth while to note that from Mr. Hart's observations it appears the total of rainfall for twelve weeks ending Sept. 6th was only one inch fifteen-hundredths, and, comparing this with the mean of the returns of Chiswick rainfall during the period from 1826 to 1869, in which the mean fall of June, July, August, and September were respectively 1.99, 2.32, 2.41, and 2.50 inches, shows that the amount of rain that fell at Kingsnorth in the twelve weeks was not as much as two-thirds of the amount of the driest of the months of which the mean fall is above mentioned.

The note of Tares is appended, as being an allied attack. Mr. Hart reported as follows :—

“ *Green Dolphin*. — Notwithstanding the stagnation produced by the long spell of the N.E. winds (a condition that renders them particularly liable to attack) the Pea-crops did not suffer from the ravages of insects till the Dolphin appeared on the scene, which was about the time the first flowers expanded. Nor did it increase so rapidly then as to prevent quite a reasonable number of blossoms setting, but eventually, favoured by the dry weather, the pest multiplied prodigiously, and stopped all further development in the plant. Starlings (true friends of the farmer) by hundreds came to feed upon them, as did, more sparingly, other insectivorous birds, such as Whitethroats, Willow Wrens, and the smaller Tits. I commenced cutting the Peas on July 24th. The ground immediately behind the men was covered with Aphides shaken from the haulm, scrambling over each other to gain some elevated point, such as a piece of stubble or lump of earth. An hour afterwards all movement had ceased, the insects having massed themselves on every available ‘point of vantage,’ giving grass, weed-stems, and stubble a superficial resemblance to the green flower-head of some orchidaceous plant. Those specimens nearest the stem were ‘lice,’ closely packed, frequently two or three

layers thick, and then outside these a coat of 'fly' with their heads all pointing upwards. Next day all the 'fly' and greater part of the 'lice' had disappeared, and then my attention was caught by what I at first thought was grass-seed, but, on stooping down, found to be cast-skins of the Dolphin, myriads of which strewed the ground where the Peas were stoutest, indicating what an immense population the Peas had maintained.

"As yet I have threshed but a portion of the crop, and cannot state positively what the produce per acre will be. Those of my neighbours, who in great measure escaped the attack, get from $4\frac{1}{2}$ to $5\frac{1}{2}$ qrs. per acre."

"*Tares.—Dolphin.*—This crop was as much infested with Dolphin as the Peas were. All of mine but about two acres were cut green for horses, &c., and latterly I was much afraid such an abundance of insects in their food would seriously affect their health. Fortunately the bulk of Aphides were dislodged either by cutting or collecting the Tares, and no harm was done. Those left for seed produced about three sacks an acre of very small Tares."

PEAR.

Common Vapourer Moth. *Orgyia antiqua*, Stephens.



Caterpillar (after Taschenberg). Male moth. Female moth, with abortive wings.

The pretty and easily distinguishable caterpillar of the Common Vapourer Moth is not so well known as it should be, on account of its destructive habits. In the words of Edward Newman ('Brit. Moths,' p. 40), "it feeds on every tree or shrub in the garden." Hawthorn and Sloe are especially frequented, but it also feeds on the leafage of Pear and other kinds of fruit-trees; of Roses and other garden plants; and sometimes on Fir.

It is found both in town and country, and has been recorded as an abundant insect throughout the metropolitan district. During the last few years specimens have been sent in from different localities. On July 22nd caterpillars were forwarded, with the observation:—"In the vicinity of Linton-upon-Ouse there are two large fruit-trees bare

of leaves through the agency of the enclosed insects. They may be counted by thousands in all parts of the garden, and this has been the case for about four years, while none of the gardens round about are touched."

Another correspondent, writing from Porchester Terrace, London, mentioned that the caterpillars "were then injuring Pear-trees, and during the previous summer had destroyed the leaves of most of the trees in that neighbourhood."

The caterpillars are very noticeable from their peculiar tufts and bunches of hair. They are dark grey, spotted with small red tubercles, and the four large tufts of hair on the back are whitish or yellowish; those at the head and tail, and the two long tufts at the side, are dark. When full-fed the caterpillar spins amongst the remains of the leaves on which it has been feeding, or in some exposed place, as on trunks of trees, palings, or the like, and there it changes to a dusky yellow chrysalis, from which the moth comes out in summer at the end of about fourteen days.

The male moths are of various shades of brown or chestnut, with the fore wings clouded with darker colour, and with a white somewhat moon-shaped mark near the hinder angle. The females are grey, and have only abortive wings. When they come out from the chrysalis they creep on to the outside of the yellowish grey, somewhat oval, cocoon, and there pairing takes place. The female very soon begins depositing her eggs on the surface of the cocoon and in the immediate neighbourhood, and then dies.

As the female moth cannot fly away, the attack may be expected, when once set up, to increase yearly, and good searching measures would be well worth while to get it under, and the fact of her laying her eggs on or near the webbed-up leaves or spun cocoon, from which she came out, may be turned to good account. Where there is bad attack all the webs that can be reached should be cut off and burnt, and walls and trunks of trees, and similar places, should be searched for webs in autumn and winter. Going over the upper part of the trees from a ladder and giving a good scrubbing with soft-soap, applied by a hard brush, to as much of the trunk or branches as would bear the application and could be reached, might be expected to get rid of the pest in whatever stage it might be passing the winter on the trees.

When the caterpillars appear on the leafage, also when the moths are coming out from their chrysalis-cases in the webs, it is probable that good dressings of soft-soap and quassia, such as are used in Hop-gardens, and similarly thrown by large garden-engines, would be serviceable.

POPLAR.

Puss Moth. *Dicranura vinula*, Stainton ; *Cerura vinula*, Stephens.



Puss Moth (male), and caterpillar (life size).

During the past summer the splendid caterpillars of the Puss Moth have been reported from two localities (curiously enough both in Fife, N.B.) as causing great damage to Poplars.

On July 30th one of these caterpillars was sent me by Mr. Joseph Low, forester on the Rothies Estate, Fife, as a specimen of what were then at work on Balsam Poplars, from some of which trees they had entirely stripped the leaves. The trees had been planted in the previous spring, and were from four to five feet high.

On August 18th specimens of this species were forwarded to me from Strathairly, Largo, Fife, by Major-General David Briggs, with the information that they had been found on young Poplar trees, the leaves of which they rapidly devoured.

The caterpillar, when full-grown, is of the size and shape figured above, and may be easily recognised by the position it is fond of assuming, with the fore part raised, as if going to fight, and the head drawn squarely back into the next segment, and likewise by the tail of the caterpillar ending in two rough horn-like prolongations, from each of which the caterpillar, when vexed or alarmed, has the power of protruding a long streamer, like a morsel of beautiful rose-coloured silken thread.

The colours of the caterpillar are purplish brown, streaked lengthwise with white lines above the white band which is shown passing in a sharply-curved course from head to tail, and below this white band the colours are chiefly greenish. When the head is withdrawn into the segment the part surrounding it is pink, with two black or dark spots somewhat at the sides.

The moths are white and grey, with black markings, so that the figure gives a very fair idea of the tint as well as the shape. From their soft downy appearance they are known as Puss Moths. The female moth is considerably larger than the male figured.

The moths infest Willows and Poplars, and lay their eggs on the leaves. When the caterpillars are full-grown they form an exceedingly tough cocoon of a kind of gluey matter. This may be made either in a hole gnawed in the bark a little above the root of their food-tree, with wood-dust and chips, or, if nothing else occurs, they will glue anything accessible together; in captivity a bit of carpet in the corner of a deal-box suits them perfectly. In this cocoon the caterpillar changes to chrysalis, from which the moth comes out in May or June of the following year.

From the great size of these caterpillars they may be readily got rid of by hand-picking on low trees in nurseries, as soon as the eye of the picker has got used to their appearance. They are not easy to detect at first, from the form and colour of the markings much resembling those of twigs and leaves: when first hatched the caterpillars are stated to be black. Where attack has been prevalent examination should be made in autumn as to whether cocoons have been formed on or in the bark of the infested trees, and, if so, the cocoons should be destroyed.

SPARROWS.

House Sparrow; Corn Sparrow (German name).

Passer domesticus.

The information of the past season concerning Sparrows continues to show the great need of lessening their numbers; the possibility of doing this by common sense measures without the slightest infraction of the law, or raising a commotion; and it also confirms the view of the *benefit received by using these measures.*

The great length at which the subject was gone into in the previous season makes it unnecessary to go again over the points, home and colonial, showing the severe losses that are going forward; but the

following observations may well be added. Mr. Gurney's opinion carries great weight, not only as an ornithologist, but (as he himself says), "a lover of birds." The other observers quoted are also well qualified to form opinions, and their observations show that the state of things similarly needs attention in widely-separated parts of the country; and Mr. Gaskell's notes in particular show that by attention something can be done to remedy the mischief by united effort in country localities.

On May 29th, Mr. J. H. Gurney, jun., of Northrepps, Norwich, wrote as follows:—"I do not look on the Sparrows as the absolute pests which some people do, but I think they do enough harm to warrant everybody in destroying them. Say one-fifth of good to four-fifths of harm is about what they do, take the country all over, *though at certain times and places they do nothing but harm*. I have striven to say all I could in their favour, being naturally a lover of birds."

The following note is from Mr. S. L. Mosley, Beaumont Park, Huddersfield, a practical as well as scientific naturalist:—

"*Corn* has suffered from Aphides, but much more from Sparrows and other small birds; some fields are shamefully devastated by the birds. I think there can be little doubt that birds are too numerous. In the spring Greenfinches did a great deal of damage to seed-beds, especially Cabbage, Turnip, and Mustard. I dissected a good many, and always found seeds in them, *very rarely* any insects."

Dr. Chapman, of Hereford, in a letter relative to amount of bird-presence in that neighbourhood, observed:—"We have here a plague of Sparrows, which are a nuisance in many ways, and I can say practically nothing in their favour."

The following remarks from Mr. W. J. Goodwin, Winfield House, Crouch, near Sevenoaks, Kent, bear on the point of the damage caused by over-supply of small birds generally in fruit grounds:—

"With regard to the small bird question (House Sparrows, Chaffinches, Green Linnets, &c.), the evil gets worse, as, owing greatly to so many mild winters, they have largely increased. I have killed hundreds with the crops full of the buds, but it does not seem to lessen them one iota. My Red Currants are eaten frightfully again this season, and in another month or so, when the Black Currants open the buds and show the bloom, they again do fearful mischief by pecking the bloom all to pieces: this I have discovered they do for the sake of the sweetness, there being a considerable amount of honey in the bloom even before it opens; but the Red Currants they peck for sheer mischief, as there was a quantity of Wheat all the winter close to my trees."

Mr. W. Alsebrook, writing from Wollaton, Nottingham, mentions Sparrows as being very destructive in the early part of the summer.

“ Now they are entirely stripping the Red Currant trees of the fruit, which at present is green and half-grown.”

Later on, on July 20th, he further remarked :—“ Sparrows are now busy taking the growing Barley. Last year, when collecting returns as Estimator for the Committee of Agriculture of the Lords in Council, several correspondents complained of the present damage done by small birds.”

Relatively to my inquiries as to the results of the work of the Sparrow Club in Wirral, Cheshire, Mr. Gaskell, Secretary of the Wirral Farmers' Club, wrote as follows :—“ We have still a quantity of Sparrows at the Corn again this year, and will, I think, never be able to avoid it, living so near a large town. Some farmers, members of our Club, living some distance out in the county, say they have not been so free for long enough. Our Club will take the matter firmly in hand soon, and try to get them slaughtered during the winter months, and about the homesteads, which, I think, the best way to get at them.”

One especial point in the trouble caused by Sparrows is the extent to which they drive away regular insectivorous birds ; and relatively to this Mr. Ralph Lowe, of Sleaford, who has for some years attended to the subject, wrote to me that at the Moat House, Leake, Boston, two years ago, “ flies ” were a pest to such a serious extent that “ the occupier had taken your advice literally, and *pretty well destroyed the Sparrows* ; the Swallows and Martins had consequently established themselves in large numbers, and the *pest of insects had ceased* to be destructive in the garden and orchard.”

On inquiry of the occupier, he was good enough to favour me with an account of the various measures used, by netting and other means, for destruction of the birds ; and besides these he gave the following note, which may be very serviceable to those who have difficulty in getting at the nests, and so destroying the pest in embryo :—

“ Nests may be taken from buildings, &c., with a thin iron rod with either a screw or hook at the end, and fastened to a long light pole.

“ Sparrows' nests may be easily discovered by observing pieces of straw, which generally hang from the nests or from holes in buildings which contain the nests. By using the screw I have already mentioned you may easily draw a nest from a place which it would be impossible to reach with the hand.

“ By tying another pole to the one you have, you can reach nests in the water-spouts on high buildings, &c.”

The need of these measures is plain to all who are personally concerned in agriculture, and to those who wish for solid information in compact form on this important subject, I strongly recommend the

study of a book called the 'House Sparrow,'* containing information by Mr. Gurney, Col. Russell, and others, who have devoted special attention to this matter, and also the names and short notes of the contents of many papers on the subject of the severe injury caused by the introduction of Sparrows into the United States of America, beginning with the warnings of Dr. C. Pickering in 1867.

The enormous increase and the great amount of damage caused by the English Sparrows imported into the American States has given rise to an investigation, on the part of the American Ornithologists' Union, as to the practical agricultural bearing of this invasion, and the results have now been published, during 1885, in the form of a regular Report. This Report is of great value, as being the verdict of a known body of ornithologists on evidence collected in long and widespread investigation. Through the courtesy of Messrs. Wesley & Son, Essex Street, Strand, I have been put in possession of the Report in full, as printed in the number of the journal entitled 'Forest and Stream,'† for August 6th, 1885; and, as the points enquired into, the information received, and the opinion expressed by the Ornithologists' Union thereon, are all of so much value, I do not apologise to my readers for the insertion of much of the paper here (though not a British contribution to my own Report), as all agriculturists will feel it meets a great need that we share with the sister country.

The following extracts show the reasons and careful method of investigation, together with the names of some of the leading members of the Society, which probably will be of interest to English ornithologists:—

“THE ENGLISH SPARROW.

“*Verdict of the American Ornithologists' Union.*

“At the meeting of the Council of the American Ornithologists' Union, held in Washington, April 21st, 1885, the committee appointed in September, 1883, to inquire into the question of the eligibility or ineligibility of the European House Sparrow in America, rendered its final report, which was accepted and adopted as the sense of the Union on the subject, and the committee was discharged with the unanimous thanks of the Union. The report, which was accompanied by a large quantity of valuable data, is here given:—

“*Mr. President and Members of the Union:* Your committee, appointed to inquire into the eligibility of the European House Sparrow (*Passer domesticus*) as a naturalised resident in this country, has the honour herewith to submit its report. After due consideration your committee

* 'The House Sparrow, and the English Sparrow in America.' W. Wesley and Son, Essex Street, Strand. 3s. 6d.

† Forest and Stream Publishing Company, 39, Park Row, New York.

adopted the following form of circular letter, which was framed to elicit information from all quarters and from all interested persons:—

“The American Ornithologists’ Union, an organisation resembling the British association of similar name, and including in its active membership the most prominent ornithologists of the United States and Canada, purposes, among other objects already engaging its attention, to determine as nearly as possible the true status in America of the European House Sparrow (*Passer domesticus*), commonly known as the English Sparrow, in so far as the relations of this bird to mankind are concerned. The Union hopes to secure through the solicited testimony of others, as well as the personal observations of its members, the facts necessary to settle the question of the eligibility or ineligibility of this Sparrow as a naturalised resident of this country. The question of the European House Sparrow in America is regarded as one of great economic consequence, to be determined primarily by ascertaining whether this bird be, upon the whole, directly or indirectly, injurious or beneficial to agriculture and horticulture. Its economic relations depend directly and mainly upon the nature of its food; indirectly upon the effect, if any, which its presence may have on useful native birds and beneficial insects. The accompanying formula of questions is respectfully submitted to the attention of those who may be able and willing to record statements of positive facts and value derived from their own experience. Concise and unquestionable answers returned to the undersigned on enclosed blank, or otherwise, or communicated to any member of the committee, will be appreciated and prove of high value among the data upon which it is hoped that this vexed question may be set at rest. The evidence thus obtained will be carefully considered by the committee in preparing its report to the Council of the Union, and a digest of the same, with recommendations, if any, will be submitted by the Council to the mature judgment of the Union at its next annual meeting. The following named active members of the Union were, at the first congress, appointed a committee to investigate and report upon this subject:—Dr. J. B. Holder, of New York, chairman; Mr. Eugene P. Bicknell, of New York; Mr. H. A. Purdie, of Boston, Mass.; Mr. Nathan Clifford Brown, of Portland, Me.; Mr. Montague Chamberlain, of St. John, New Brunswick; the committee having the power of increasing its membership at its discretion.—Dr. J. B. HOLDER, Chairman, American Museum of Natural History, Central Park, New York city, Feb. 2nd, 1884.

“Data concerning the European House Sparrow from.....—1. Is the European House Sparrow (*Passer domesticus*) known in your neighbourhood, and, if so, about when did it appear? 2. Is your neighbourhood city, suburbs, or country? 3. Is this Sparrow abundant? 4. Is it increasing in numbers? 5. How many broods and young, yearly, to a pair? 6. Is this Sparrow protected by law? 7. Is it artificially fed and housed? 8. Does it molest, drive away, or diminish the numbers of native birds? 9. If so, what species? 10. Does this Sparrow injure shade, fruit, or ornamental trees? 11. Does it attack or injure garden fruits and vegetables? 12. Does it injure grain crops? 13. Is it an insect-eater or a seed-eater? 14. What insects, if any, are chiefly eaten by this Sparrow? 15. What is the principal food it carries to its young? 16. What insects, if any, are carried by it to its young? 17. Does the food of the old bird vary with the seasons, and, if so, in what way? 18. Does the food of its young vary, and, if so, how? 19. If any insects are eaten, are they beneficial or injurious species? 20. Does the Sparrow eat the larvæ of the Vapourer Moth (*Orgyia leucostigma*)? 21. Does it eat ichneumon flies? 22. Do you determine the nature of this bird’s food and that furnished by it to its young by inference, direct observation, or dissection? 23.

Have any injurious insects been exterminated or materially lessened in numbers by this Sparrow? 24. Have any injurious insects increased in numbers, or appeared where unknown before, in consequence of the destruction of other insects by this Sparrow? 25. Have these Sparrows in your neighbourhood been destroyed systematically or otherwise, and, if so, by what means? 26. What bounty, if any, has been offered for their destruction? 27. What is the general sentiment or balance of public opinion respecting the European House Sparrow in your locality? 28. On the whole, in your judgment, is this Sparrow an eligible or ineligible species in this country?

“In order to secure a thorough presentation of the subject to those most likely to respond satisfactorily, each member of the committee assumed the duties of correspondence in his own section of the country, as well as in certain allotted sections of the entire United States and Canada. Copies of the letter were sent to the agricultural papers, to the various journals having columns devoted to zoological and rural matters, and to the press at large. The greater part, however, was directed to individuals believed to possess facts pertinent to the subject. About one thousand copies were thus sent out.”

[The replies to the first question give information as to the first introduction of the Sparrow in different localities, and, with the next paragraph, show the rate at which the pest multiplies.—ED.]

“The earliest date of importation known to us is 1858, when Mr. Thomas A. Deblois liberated a few individuals at Portland, Me. These disappeared shortly afterward, and were not successfully replaced until 1875. In 1858 Sparrows were liberated at Peacedale, R. I., by Mr. Joseph Peace Hazard. They were first introduced into Central Park, New York city, according to Mr. Conklin, the superintendent of the menagerie, in the year 1864. In 1860 Mr. Eugenie Shiefflin turned loose twelve birds in Madison Square, New York city. In 1868 the species was first introduced into Boston Common. In 1869 a number were given the liberty of the parks of Philadelphia. Somewhat later a successful attempt was made to establish a colony near Great Salt Lake, Utah, and about the same time the birds became resident at Indianapolis, Ind.

“In a period of about ten years the Sparrows reached nearly all the large towns and cities of New England and the Middle States, and many of those of the Western States, without artificial assistance. It also made its appearance in suburban towns and even country villages. From the Southern States and the Western States beyond the Mississippi River we have received but few returns, and most of these state that the Sparrow has not been observed. In Canada it has become generally distributed over the southern sections of Quebec and Ontario (it is abundant in the city of Quebec), and in 1884 several flocks invaded New Brunswick.”

[Notes are given of rate of increase; that “there is an over-

whelming mass of testimony to the effect that the Sparrow drives away certain of our most valued species of native birds"; views of those whose crops have suffered, and those who have not known this happen; and the statement "that the bird feeds on fruit is amply attested."—ED.]

"Our thirteenth question calls for information as to the Sparrow's preference for food. Is it an insect-eater or a seed-eater? Every reply to this question, which is based upon dissection, agrees in attributing to the bird a diet almost wholly vegetable. The statement of some observers, that it devours canker-worms and a variety of insects, is unaccompanied by reports of examinations of the stomach."

[Various other observations are given, which space does not allow of mention of, and the result of the whole is summed up as follows: the italics are my own.—ED.]

"The balance of public opinion is strongly adverse to the Sparrows. Our returns, however, show protective laws (usually the same statute which provides for the security of other small birds) in Maine, New Hampshire, Vermont, Rhode Island, New York, New Jersey, Ohio, Michigan, the District of Columbia, and Canada. *The Massachusetts law has lately been repealed, and specially exempts the English Sparrow from protection.*

"So much for the evidence. We have learned the capacity and disposition of this bird to injure grain and fruits, and that when gathered in large numbers it threatens very seriously the interests of the farmer and horticulturist. Although testimony of a certain kind indicates that its young are fed with insects, actual dissection shows that vegetable substances are mainly employed. The adult birds feed almost exclusively upon seeds and grains. They drive away from their accustomed haunts, either directly or indirectly, many of our native insectivorous species. It may be added that they have proved in recent years so destructive of crops in other countries as to render it necessary to enact laws looking to their extermination. In view of these facts, your committee believes that the European Sparrow (*Passer domesticus*) is an ineligible species in this country, and that it was a mistaken policy to introduce the bird. And we would respectfully recommend:—

"(1). *That sheltering or otherwise fostering the Sparrow by the public be discouraged, and that its introduction artificially into new localities and its sale for such purposes be forbidden by law.*

"(2). That all existing laws protecting the Sparrow be repealed, and that bounties be offered for its destruction.

(Signed) J. B. HOLDER, Chairman,
EUGENE P. BICKNELL, H. A. PURDIE,
NATHAN CLIFFORD BROWN, MONTAGUE CHAMBERLAIN.

“ [*The Michigan law protecting these birds has been repealed.*—ED. F. & S.] ”

In the above abridgment I have omitted about a third of the entire report, as bearing on points of less interest to ourselves, but it will be seen the digest of the whole is given in the words of the original document in the concluding paragraphs, and I would particularly draw attention to the recommendation “that sheltering or otherwise fostering the Sparrow by the public be discouraged.” It will be noticed that in the United States of America the law for protecting these birds has been repealed in the States of Michigan and of Massachusetts, but in our country the provisions of the Wild Birds Protection Act leave it entirely in the hands of any occupier or owner of land to kill, or to give permission to whomsoever he will to kill these pests even in close time ; and no owner or occupier would wish shooting or trapping to go on without his permission being granted. But “sheltering and fostering” the Sparrows is quite another matter, and, from personal knowledge, I believe a great deal of mischief is going on in this way throughout the country under mistaken views of kindness.

During the past winter Sparrows have been sold in London at a shilling a dozen, and it would be a great improvement in the order of things if they were generally and at the right time of year made serviceable in forming very good pies and puddings for *our* own food, instead of taking our daily bread for *their* own satisfaction.

We know with certainty from the State Entomologist of New York State of measures being in hand to check the increase of this pest in New Jersey by a bounty per head for Sparrows destroyed ; and, as far as my own opinion goes, I believe that a similar course throughout this country, carried on with a due regard to legal restrictions at the time when this bird shares the protection accorded generally to wild birds, is a measure urgently called for, and that all farmers would benefit enormously, both in direct saving of crops and vegetables, and in the return of serviceable insectivorous birds.

TURNIP.

**Surface Caterpillars; Caterpillars of the Turnip or Dart
Moth. *Agrotis segetum*, Westwood.**



AGROTIS SEGETUM.

Common Dart Moth ; 1, moth ; 2, caterpillar.

Each year the damage caused by surface caterpillars becomes more and more plainly shown, both in the extent of their depredations and in the variety of field-crops, which they injure to a serious extent in the spring, as well as in the late summer and autumn.

The description of these grubs and their habits has been given previously in these Reports, but it may be just mentioned that the Turnip Moths commonly appear early in summer, and the caterpillars hatch in about a fortnight after the eggs are laid. These caterpillars live through the winter, which is a very important item in their history, as thus, under circumstances favourable to them, we have sometimes a spring attack of the full-grown grubs before they turn to the chrysalis-state in the earth, from which the moths come out in about a month.

In 1884, Mr. Glenny, of Barking, recorded, on the 27th March :—
“We have had plenty of the Cabbage grub marching about lately, which is an uncommon outcome of a mild winter. . . . I never noticed them so lively in February before.”

A bad attack followed this early appearance, and in the past season of 1885 the grubs were again recorded as being seen early ; and we know only too well that their autumn devastations were a very serious matter.

Mr. Hart, of Park Farm, Kingsnorth, Ashford, Kent, noticed as follows :—

“*Surface Caterpillars.*—Early in March it became evident that there was something wrong with Winter Beans, and, as the month advanced and dry winds prevailed, the Bean-tops were blown in all directions, leaving the ground bare in certain places. It was some

time before I could discover the cause of the mischief, but at last a warm shower mellowed the ground, and the pest came nearer the surface. Horse- and hand-hoeing were pushed forward, genial showers caused the Beans to shoot out beneath the wound, and a good crop was grown. In the case of a piece belonging to a neighbour the plants never rallied, and the crop was a failure. The attack was pretty general in the Winter Beans round about here, but partial in the spring-sown crop."

The following observations show the large extent of country over which the attack spread in England, and the great amount of mischief done. The caterpillars are reported as "clearing off large patches," "committing great ravages," an "eight-acre field being cleared by them," &c.; and, with regard to number of caterpillars, they are noted by observers variously as "from one to five or six being found at each plant"; "you have only to turn over a clod to pick up two or three," &c.; and Prof. Allen Harker, writing from the Royal Agricultural College, Cirencester, mentioned "We had an *enormous quantity of Agrotis segetum* larvæ in our Turnip and Mangold plots this autumn."

None of the remedies which have been tried appear successful, except hand-picking, which, though tedious, is sure, and answers so long as the plants are in a condition for the treatment to be applied, and also (when the ground is empty) turning on pigs to clear the grubs appears a good measure, by which the ground may be cleaned before the next crop is put in.

The first notes of severe attack were forwarded on July 28th by Mr. Douglas Vanderstegen, together with specimens of surface caterpillars from under his Swedes near Reading. He observed, the grubs "are clearing off large patches of them, and we thought by the Rooks laying at them and pulling them up that they were being eaten off by Wireworms, so had the Rooks kept off. There is no doubt that the grub is doing the mischief, not the Wireworm."

Grubs (then about a quarter grown) were forwarded from Asganby, as specimens of the grubs which were "making such work amongst our Turnips alike on sand, clay, and fen."

Col. G. Coussmaker's experiments near Guildford are of service in showing the little use that various applications often tried are really of, and if we had more records of trials such as these it would often save loss of crop and money in trying useless applications, just when a stringent known remedy is wanted at once.

On the 3rd of August, Lieut.-Col. G. Coussmaker, writing from Westwood, Guildford, mentioned injury from Turnip caterpillar occurring coincidentally with injuriously dry weather and north-easterly winds. Four acres of Swedes, which a week before had been thriving, were at the time of writing devastated by the caterpillar. Two men

were then employed scraping away round the roots and killing the grubs.

At my suggestion Col. Coussmaker was good enough to try the effect of soft-soap and kerosine on the Dart or Turnip Moth caterpillars, and reported thereon as follows :—

“ I have tried the soft-soap and kerosine on the Dart Moth caterpillar, and found that when it touched them it killed them. I put some on to a clear piece of ground, poured a little on them, covered them over with earth, and in a couple of hours uncovered them : they were dead. Others I put in a similar place, covered them over with earth, and watered them with the preparation, but it had not soaked through enough, and they were none the worse.

“ I also poured some round several plants. In a very few cases the grubs had worked up, and were lying dead, but in the majority of cases it had not affected them. I therefore continued the hand-picking over the whole four acres, and propose to send a woman round with the mixture in pails, and instruct her to give a couple of spoonfuls to each plant ; it may keep them off in the future. Besides the Dart Moth we found several Yellow Underwing caterpillars. We have put some in dry salt, in grey lime, in sulphur, and in soot, and they have seemed none the worse. Gas-lime did kill them, but then that would not do for the plants.”

A fortnight later (on August 21st), Col. Coussmaker reported further :—“ I have had the four acres of Swedes examined by men and women. They have killed great numbers of the larva of the Dart Moth and the Yellow Underwing, and a few common Wireworms.

“ As the caterpillars do not always lie close to the roots, I found that the application of soft-soap and kerosine oil was not of much use. Those which it touched did die certainly, but when we began to scrape away the earth we found many several inches away quite unaffected.”

From a farm at Clent, near Stourbridge, Worcestershire, Turnip Moth caterpillars were sent, on August 4th, as specimens of grubs which were devastating a field of Swedes, from one to five or six being found at each plant ; and on August 22nd specimens of the same caterpillar were forwarded from Cornwell Manor, Chipping Norton, Oxon, where they were infesting White Turnips and Swedes, “ eating through the root and causing the plant to wither and gradually die off.”

On August 12th specimens of the same (Turnip Moth) caterpillar were forwarded from the neighbourhood of Taunton, with the mention that they had “ been this year very busily engaged in attacking the Mangolds and Swedes, and were frequently very injurious in that soil.”

On August 12th specimens were forwarded from a farm near Cleobury Mortimer, Salop, with information that they were destroying a field of Swedes, "at least two at every root"; and also, on August 13th, Mr. James Craig reported, from Weston-under-Lizard, near Shifnal, that grubs were eating the Swede Turnips just by the ground: attack was noted as very bad in that locality, great patches of the fields being bare. One or two of the grubs were to be found at the root of each Turnip showing signs of distress. (The specimens accompanying were of surface caterpillars, much resembling the common kind of Turnip Moth caterpillars, but unusually dark in colour).

On August 19th specimens were forwarded through the hands of a correspondent in Lincolnshire, with the remark "that as they were out of reach of the Rooks (even if they fed upon them), and any application to the land would probably be worse than useless, there remained only the rather expensive process of pulling up the withering Turnip, gathering the grubs, and so preventing their migrating to healthy plants, serving out the Turnips pulled up to the young cattle upon their hard bare pastures."—Communicated by Mr. R. Lowe, Sleaford.

On August 25th, Mr. W. Clark, Rostellan Castle, Co. Cork, forwarded Turnip Moth caterpillars, and also a Turnip, as eaten by them, from the field of a neighbour, with the following observations:—

"The field is a sharp stony land on old red sandstone, and has been bad with the grub ever since it was ploughed in the winter. The crows never lay out of it, and must have destroyed thousands of the grub, as one was shot and found to contain about a handful of the grubs. Now (August 25th) you have only to turn over a clod, and you can pick up two or three. They cut the Turnip across about an inch below ground, and, if not completely bitten through, the plant turns purple and dies off."

On Sept. 1st more of "the brutes" were forwarded, with the note that the state of the field was getting worse and a great part of the crop was already gone, and the following observation, which is of interest relatively to attacks of the caterpillar recurring in successive years on the same ground:—

"The Oat crop on the field last year was miserable, scarcely the seed being got from it. When ploughed great numbers of caterpillars were turned up and eagerly devoured by crows, who would make good scavengers just now, but are getting too much corn to think of caterpillars. Some Turnips have about twenty caterpillars round them."

Turnip Moth caterpillars were forwarded, on the 31st of August, by Mr. H. W. Green, from West Lavington, Devizes, with information that, during the dry weather then prevailing, they were committing great ravages in that part of the country, both on Swedes and Turnips.

One piece of Swedes of about twenty acres had suffered severely, quite eight acres being cleared. It was noted that the ground had worked down very fine, and the Swedes came up well and looked healthy; they were hoed and singled out, but a week before the date of communication they began to disappear. As many as four of the grubs were to be found at one plant, which they ate right into, and soon caused its death.

On August 31st information was forwarded by Mr. H. Marshall, of Poulton Priory, Fairford, that the fields were devastated by what turned out, when specimens were forwarded, to be the generally destructive "Turnip Moth caterpillar, the grub of *A. segetum*, and that nothing would induce the Rooks to look at them. Barley-sheaves had been placed about one field to induce poultry to hunt for them, and the poultry did go out and catch a good many, but would not stay out. They appeared unable to stand the sunshine, and under many places where they had scratched there were still grubs."

It will be seen from the above notes that the main brunt of attack was reported during August, and observations sent of severe attack from these surface caterpillars at localities in Somersetshire, Surrey, Worcestershire, Oxon, Salop, Lincolnshire, Wilts, Gloucestershire, and from Co. Cork, Ireland; also before or after from Kent, Essex, Berks, and Staffordshire.

The following communication from Mr. W. W. Glenny, of Barking, is of special interest as showing, from notes of a thoroughly skilled observer, not only the severity of the ravages of these pernicious grubs, but the great variety of crops which they ravage:—

"In the autumn surface grubs were plentiful after the dry summer, and greedily devoured food of a varied character. It was difficult to escape these omnivorous insects, for no field and no crop was free from their inroads. Amongst transplanted Leeks and Cabbage they did most harm, yet they equally bit off, just near the top of the soil, Turnips, Spinach, Onions, Beetroot, Carrots, Lettuce, &c. Instead of describing which plant they prefer, it would be easier to say that there is no vegetable or herb they refuse.

"The late Potatoes were damaged by them, and a fair piece of Magnum Bonums was attacked in such a manner that, though it would have been convenient to have allowed the crop to mature and ripen in the field, it was absolutely necessary to dig the produce to prevent the grubs eating them all. It is not only the portion of the tuber consumed that is lost, but where the insect works his way into it much of the edible substance changes colour, and is wasted."

On Sept. 14th caterpillars of *Agrotis segetum* were sent to me by Mr. Alex. Crossman, from Longcrofts, near Burton-on-Trent, as specimens of a grub which was then completely destroying three acres

of Turnips, and also Swedes in another field on the opposite side of the farm. As many as five to seven caterpillars were to be found at one root. Mr. Crossman remarked :—

“ The crops that are attacked were sown on the ridge, and manured with farm-yard manure and vitriolised bones ; but, owing to the extreme dryness, the manure has not amalgamated with the soil in the least. I imagine the grub has hatched from eggs deposited in the manure, either since it was ploughed in, or in the heaps before.

“ My Mangolds, which were sown on the flat without farm-yard manure, are quite free from the grub. To try whether lime will kill them, I threw a dozen on to some fresh-slaked lime, into which they burrowed, and the next day were mostly dead, though one appeared not in the slightest degree the worse.”

Mr. Crossman further noted that he found the grubs mostly in land dressed with stale and inferior manure. His Cabbage crop was quite free from them, though it was heavily manured from the farm-yard, but with the addition of lime.

[Mr. Crossman conjectures from this that the eggs may have been laid in the previous summer in the manure-heaps, and it is impossible to say whether or no this was the case. Where neglected manure-heaps are left (as I have seen some, not very long ago), running to lengths of ninety yards, and left by the lane-side until they were smothered in weeds, it is impossible to say but that caterpillars and chrysalids, of endless kinds, may be carried in the stale manure on to the field.—ED.]

On Sept. 15th, Mr. J. D. Sherston forwarded specimens of the Turnip caterpillar (*A. segetum*) from Evercreech, Somerset, with the note :—

“ I have a five-acre field in which the grub I send you herewith abounds. It was broken up from Sainfoin and seeds six years old last year. We had a crop of Swedes, very fine, except in patches, which went off after the plant had grown for a month or more. Oats followed, and that went off similarly. The land is worked down to plant *Trifolium*, but this grub abounds so that it is obviously useless to plant anything.

“ We applied nitrate of soda to a part of the Oat crop last spring, and there the grub equally abounds ; and on one part where lime happened to be applied very thickly the grub was there equally.”

A letter from Mr. Sherston, on Sept. 17th, mentioned, relatively to remedies suggested, “ My man tells me the pigs seem to be very busy after them.”

On Sept. 26th, Mr. Cecil Hooper forwarded some caterpillars of the above kind (*Agrotis segetum*) from Claverley, Bridgnorth, as specimens of what were then doing much harm to young Turnips. The

caterpillars ate the leaves down to the crown, and were then lying buried round the roots, in the way in which they are the most commonly observed.

The following note by Mr. David Rowland, of the Balance Farm, Titley, may very probably refer to the same kind of attack, but whether this is so or not the observation is well worth notice, relatively to the effect of sudden and plentiful rain in destroying grubs. Instances of this have been given before, and, under the head of "Oak Leaf-roller Caterpillar," another instance is given in the present Report of this effect, and the fact is worth notice, though at present we have not either enough water-supply saved up, or enough power of agricultural machinery, to make artificial drenchings available at a paying rate. Mr. Rowland's note is as follows:—

"In the spring of 1884 I had a field of Oats somewhat damaged by a grub varying from half an inch to an inch in length, of a dirty earth-colour, and of the thickness of a small straw. It is much more common here than Wireworm, and I think much of the mischief attributed to the latter is really due to the former.

"The season was cold and dry, with east wind, and the growth of the plant was checked. On searching I found this worm in great numbers about half an inch in the soil, *none appearing above ground*. On the following day a good deal of rain fell. On going over the field next morning I found, to my surprise, that the worms were hurrying about in all directions, some dead, some dying, and the others seemingly ill at ease and uncomfortable. It struck me then that the improvement following upon rain is not due altogether to the fresh growth induced by the rain, but that it (the rain) has a fatal effect on the worm."

One curious circumstance in the habits of these caterpillars, which, so far as I am aware, has not yet been brought forward, is the appetite with which, when restricted from other food, they will prey on one another.

About August 16th I received some Turnip Moth caterpillars, of which one so completely disappeared that I conjectured his companions had eaten him, and consequently I placed two by themselves in a box. Being away on business for a few days they remained unexamined until the 25th, when, on opening the box, I found one caterpillar remaining, but only the horny head of the other.

On the following day more Turnip Moth caterpillars were sent, and I confined three in one box, without other food than their carnivorous propensities might find from each other, and on the following morning found one caterpillar much as on the previous day; another much grown, shiny, plump, and most thriving; whilst the third tenant of the box was represented merely by a horny head, a

small bit of the end of the tail, and some connecting skin. The same occurrence took place repeatedly on successive trials, but I never found that a grub which had eaten another was himself consumed by his brethren. This habit may possibly help us by some degree of what may be called self-clearance of the caterpillars, where infested land is so thoroughly surface cultivated as to remove their special foods, but we do not know this for certain.

As these grubs live through the winter, it is well, where absence of crop allows, so to stir and turn the surface of the ground to the depth at which the grubs may be lying that they may be turned out to the effects of bad weather. Alternate frost and thaw will kill them when exposed to weather action, but, if turned out early in the autumn, they will then be still able, if allowed, to crawl away to remake or regain winter shelters. In such cases turning on pigs to follow the plough is of great service.

It has been stated that the attack does not occur where ground has been well salted, but this attack is one on which we very much need further information.

WHEAT.

“Ear-cockles”; “Purples”; “False Ergot”; Galls of Wheat Eel-worms. *Tylenchus tritici*, Bastian; *Vibrio tritici*, Curtis.



Wormlets escaping from eggs; section of Cockle-gall, with wormlets within; after Brauer's figs. (much magnified). Spikelet of Wheat, with galls (magnified). *T. tritici* wormlet (greatly magnified). Nat. length of largest one-seventh to one-fourth inch.*

The *Anguillulidæ* are excessively small, transparent, cylindrical worms, tapering more or less at each extremity; the “Eel-worms”

* This paper has been placed under the special heading of “Wheat,” as the information was not procurable in time for its insertion under the general heading of “Corn and Grass.”

to be found in old paste may be taken as an example of the general appearance of this division of "thread-worms."

A good many kinds—some seventeen or so—have been recorded by Dr. Bastian as having been found either definitely doing injury to various kinds of corn and grass, or being found at the roots, or amongst the sheathing-leaves thereof.

It is difficult to convey any exact likeness of the wormlet at this size on wood, but the figure gives the general shape, and the upper end shows moderately the spear or proboscis in the mouth-end, though not its three-lobed base; also the rounded muscular swelling just below, which is one of the characteristics of this species; and the coarse fat granules in the intestine. The colour is yellowish white, and the largest wormlets are from a seventh to even a quarter of an inch in length.

The method of attack, as quoted by Dr. Bastian from M. Davaine's experiments, is, that when the infested galls are sown, these galls become softened, and the wormlets within, thus being able to escape, make their way to the young shooting plants, "and then insert themselves between the sheaths of its leaves, gradually working their way round till they come to the innermost of these, where they remain for a variable time, without increasing much in size, till the rudiment of the future ear begins to form." Whilst this is still so young that the future portions of the flower are not yet distinct, and are still of soft cellular tissue, the wormlets introduce themselves within these portions, and the gall-like growth of "Cockles," or "False Ergot," is the result.

The "young worms soon become perfectly developed males and females. These vary in number from two to twelve in each gall, and, after producing an enormous number of ova [eggs] containing fully-formed young (which speedily liberate themselves, though they afterwards undergo little change), themselves die and wither at the time when the gall begins to assume its characteristic purplish-black or brown appearance."

The above is partially quoted, partially abridged, from Dr. Bastian's account of his own observations, and those of Davaine.*

In regard to the power of the wormlets of withstanding most of the application which can be commonly brought to bear on them, it is mentioned by Taschenberg "that a temperature to which the corn cannot be heated without losing its growing power does not kill the worm, nor the most severe cold reach them in the egg," and they may be dried till apparently dead, and restored by warmth in connection with dampness time after time without receiving injury. They will

* "Monograph on the Anguillulidæ," by H. Charlton Bastian.—'Trans. Linn. Soc.,' vol. xxv., pp. 87, 88.

live for a month in clean water, and in solution of some kinds of alkaloids; “*but sink at once under the effect of acid or metallic salts.*”

The injury caused by the “Cockle” galls in the ear is well known, but to what extent the presence of these gall-wormlets, or others of the *Anguillulidæ*, causes injury to the roots or leaves, or shoots of Wheat, or other corn or grass, needs attention being drawn to it.

Prof. Henfrey and Dr. Griffith mention the Wheat-wormlets as “sometimes infesting the young plants, burrowing in the leaf-sheaths, where we have found them reproducing by ova in great numbers.* Dr. Bastian mentions procuring diseased and stunted growth of Wheat plant by using seed which was artificially infected by him with wormlets from a “Cockle” gall of this same kind (the *T. tritici*).

Mr. Carruthers (Consulting Botanist of the Royal Agricultural Society), in his paper on “Purples” or “Ear-cockle” in Wheat,† alludes to disease caused in the substance of one of the central stems of young Wheat plants by the Wheat-wormlet (*T. tritici*), or an allied species; and in his yearly report, presented to the Royal Agricultural Society in December last, he gives the following account of diseased and distorted growth of Oat plants, caused either by the *T. tritici* or some allied species of the *Anguillulidæ*.

Mr. Carruthers stated that several cases of Oats destroyed by these wormlets had been brought under his notice in the past season. The Oats, having reached a height of four to six inches, had their growth stopped, and the plants on examination were found to have a number of curled-up, twisted, and knotted shoots at the base of the stem under the ground or just above the surface. When an injured plant was examined it was found that the first or main stem was dead. This had been caused by the attack of the minute worms, and the young shoots thrown out below the point of attack, being in some cases destroyed and in some weakened in their turn by the presence of the wormlets, were checked in growth, and the distorted condition above mentioned, with crumpled and swollen buds round the base of the plant, was the result.

A very similar attack is caused by another of these wormlets or eel-worms, the *Tylenchus dipsaci*, Kuhn, on Rye, known, amongst other names, as “Thick-top.” Without entering on full details, it appears the inside of the shoot dies, as above mentioned, and sometimes the embryo stem is so stunted that the knots are close on one another, but the whole stem not above an inch high, up to the ear; sometimes a sickly ear is produced from the mass of shoots, and throughout the unhealthy plants the wormlets may be found as eggs, young, or in

* ‘Micrographic Dict.’ by J. W. Griffiths, M.D., F.L.S., and Arthur Henfrey, F.R.S., F.L.S., &c., p. 37.

† ‘Journal of the Royal Agricultural Society,’ vol. xviii., p. 348.

perfect condition. They are found in the haulm and ear-spike, and their presence in the sheathing-leaves may be known by showing as light specks, "partly through the destruction of the cellular tissue on which they feed." The young wormlets are stated to "sometimes remain in the haulm, as well as in the tops and seeds, and develop later, when they lie in the straw in the earth."*

This point of the wormlets lying in the remains of the plant is a very important one relatively to measures of prevention.

Dr. Bastian mentions various different species of *Anguillulidæ*,† which are to be found between the lower part of the sheaths of leaves of Wheat and Oats in stubble; and the above observations taken all together point to the possible origin of a deal of mischief that at present is at times merely a cause of perplexity, and likewise to practical measures for lessening it.

Means of Prevention and Remedy.—The statement of Dr. Taschenberg that the wormlets go down before acids or metallic salts at once suggests that in this case steeps would be of service, and it is mentioned that the well-known steep of sulphate of copper, likewise of dilute sulphuric acid, are of use in killing the wormlets in the "Cockle" galls, and thus preventing infection being sown with the seed. Of course, as in all other cases, care must be taken that the steep is not strong enough to injure the growing power of the seed.

The method of application is to place the corn in a vessel with the steep, so that the liquid shall be a little above the surface of the corn; then stir the corn gently, and skim off the galls ("Cockles") that rise to the surface. Thus, as Dr. Taschenberg aptly remarks, "we kill two flies with one blow."

I have had little opportunity of trying the experiment myself, and only with old galls, but certainly about half remained floating, and of the rest some constantly rose on being stirred. If as successful as seems likely, this treatment would strike at the root of carrying out the start of new attack to the field.

The point of the wormlets being seen in stubble, and buried in it, is very important; skimming the surface of the stubble-fields and burning the collected trash would get rid of this source of mischief.

During the past season the distorted, stunted, and massed growths of young corn similar to those above described have been personally brought under my notice, so far as to give reason for thinking that the subject needs much attention; but, as no insect-presence is noticeable, the attack is not as much forwarded to me as I could wish.

* 'Praktische Insekten kunde,' by E. L. Taschenberg.

† Notably *Plectus tritici*, *Aphelenchus avenæ*, *Cephalobus persegnis*, *Rhabditis ornata*. See "Monograph on the Anguillulidæ," by Dr. Charlton Bastian, 'Trans. Linn. Soc.,' vol. xxv.

OBSERVATIONS
ON
WARBLE FLY OR OX BOT FLY,

Æstrus bovis, Clark; *Hypoderma bovis*, DeGeer.



MAGGOT.



OX WARBLE FLY.



CHRYsalis.

DURING the last year a large amount of communication regarding warble-attack has taken place with cattle owners, dairy farmers, veterinary surgeons, and others practically conversant with the attack in all common states on the live animal; and also with many leading firms of leather factors and tanners in various parts of the country relatively to the great loss on hide, a matter confirmed by communication with others engaged in the manufactured leather trades, as carriage-builders, and saddle, and boot and shoe makers.

The great mass of communication received makes it rather difficult to give the result in terse and comprehensible form, and in any moderate compass. I have therefore taken the main points and divided them into two parts, the first including what may be called the field or practical part, as damage to health of the animals, some statistics of loss, means of remedy by destroying the maggot, and means of prevention by keeping off the fly. The second part contains observations from life of the growth of the maggot and warble, from the first stage in which it is noticeable by the naked eye; with some additional notes, also from life, regarding the development of the chrysalis and fly. The first part shows what is found to answer, and the second the reasons why, from the nature and condition of the maggot in its different stages, this or that application may be expected to have the desired effect on it.

I have to thank a very large number of correspondents for the great assistance they have kindly afforded me by their communications, which are duly acknowledged with their names appended in the following pages; but my thanks are especially due to Messrs. Fry and Co., Leather and Hide Factors, Moor Street, Birmingham, for the assistance they have given me by their introductions in drawing widespread attention to the subject, and likewise obtaining distribution of information thereon.

At a rough calculation about 10,000 to 15,000 of my 'Observations on Warble Fly,' and 15,000 to 20,000 of my Notes, have been distributed, and I trust have in some places raised useful attention.

Pamphlets have also been forwarded by request to various localities in the United States where attack exists, and consequently co-operation in prevention is desirable, as the attack is readily carried.

PART I.—OBSERVATIONS REGARDING AMOUNT OF WARBLE-PRESENCE, MEANS OF PREVENTION, REMEDY, &c.

The following observations give examples of the severity to which warble-attack runs. Such specimens as were sent accompanying were in a shocking condition, and, if not the cause of the death of the animals, must have severely aggravated the effects of illness.

"I to-day received the skin of a young bullock, about one year and a half old, which was very much warbled, and which showed signs of a considerable amount of inflammation. I have cut a piece out and forward it for your inspection. . . . You will notice that the membrane covering the warble is much thinner than at a later period. I cannot help thinking that the death of this animal has been brought about solely by warbles; the irritation caused by the presence of so large a number must have been very great, and it may be supposed the draw upon the system to supply such a large colony with food must have been more than could be borne."—JOHN DALTON, Wigton, March 28th, 1885.

[The thinness alluded to was very noticeable, the segments of the maggot being clearly discernible through the membrane. The piece of hide contained eight or nine warbles in a space of not more than two and a half inches square, and was in a state of inflammation. The maggots were upwards of a sixth of their full growth, and the warbles containing them in some cases so close together as not to be clearly distinguishable from each other.—ED.]

"Almost immediately after receipt of your letter to-day we had the skin of a yearling sent in; it was covered with warbles down the centre of the back. The man who brought it said they considered it died of 'blackleg.' We think the warbles killed it. This makes the

fifth within the last four or five days, all supposed to die of 'blackleg, or quarter-evil,' but all equally affected by warbles. By this post we send you a box of the maggots, all of which the writer cut out within the space of this sheet of paper."—Messrs. C. and H. Hatton, Barton Tannery, Hereford.

"We received a hide to-day taken off a beast supposed to have died of 'blackleg.' Looking at it spread open, it was most distressing to think that a poor beast should be allowed to get in such a state. However, we have cut the centre out, and send it you by this post."—Messrs. C. and H. Hatton, Barton Tannery, Hereford.

[The piece of hide was 28 in. long by $8\frac{1}{2}$ in. at the widest part, and contained upwards of seventy-two warbles.—ED.]

"Yesterday I inspected the carcase of a heifer which had died from the effects of calving; there were nine warbles well developed, but, when the skin was taken off, I counted up to twenty on the flesh-side. The beast was miserably poor, neither fat nor flesh, the emaciation, I affirm, from the effects of the grub."—RALPH LOWE, Sleaford.

The above notes lead on naturally to the consideration of direct damage to health of the infested animals from the maggot-workings. It needs no proving that where there are dozens and scores of maggots up to an inch long, sucking food in the ulcerated holes under the hide which they have caused, and which they are keeping in flow, that there must be a great drag on the system of the animal, and the condition must also be affected by the presence of *patches* of great holes an inch or more long under the hide, by which it is, so to say, "honeycombed" away to the extent of the number of these cavities from the flesh beneath, and likewise a high state of inflammation is at times to be found even at the first commencement of the attack on the flesh-side of the hide.

But, independently of all this obvious evil, there is the question, *what is the kind of pain that is caused by the direct maggot working?* The beasts cannot explain this; therefore, being aware that warble-attack (that is, attack of various kinds of *Æstrus* larvæ) occurs not unfrequently to the human subject in the more central parts of America, I wrote on the subject to Mr. Everard im Thurn, now resident in British Guiana, and well known for his scientific attainments, and also as the scaler of the (previously supposed inaccessible) mountain of Roraima, in those regions. Mr. im Thurn replied that he had himself suffered from the attack of a warble-maggot a little below the knee, and he described the pain as not being constant, but from time to time quite sharp, as if the maggot was screwing itself round in its hole. This gives an idea of one kind of pain connected with attack of *Æstrus* larva.

Further, on communication with Mr. J. S. Macadam, Army

Surgeon, British Guiana, he informed me that he had seen a case as follows:—A black soldier of the 1st West Indian Regiment presented himself, complaining of a sort of large boil, with hard edges, on the front of his throat, which had broken and would not heal up, and that the *itching round it at times was intense*. On investigation the end of a maggot was seen in the sore, and the patient was found to have several of these boil-like swellings, one on the back of the neck, and others about the body. These other swellings at the time had only small openings, through which the creature protruded one extremity. Mr. Macadam remarked:—“I treated the case by simply excluding the air from the creatures. I placed a piece of sticking-plaster over the larger one, and painted over the smaller ones with collodium only, and, after the lapse of three or four hours, the creatures were squeezed out dead with but little difficulty. I removed five or six of the creatures, . . . the largest about three-quarters of an inch in length, the remainder about half an inch.” Mr. Macadam gave some sketches* of the shape of the maggots, and noted they reminded him much of cattle-bots; and that he was informed by one of the officers of the 1st West Indian Regiment, who had been quartered in British Honduras, that they were very common there, and went there by the name of “Beef-worms.”

Mr. Macadam further noted, in reply to my enquiry regarding pain:—“It would appear that the man suffered but little inconvenience from the presence of this creature in his body further than *intense itching*. Of course certain amount of inflammation must have accompanied the development of the boil and hardening round it, but apparently so trivial as to cause but little notice till the boil suppurated, when the pain of an ordinary sore plus the intense itching, the only thing complained of, was felt.”

From the above medical statement, which, it will be seen, is most carefully limited to precise report, it appears there is the “necessary” pain when the boils are developing, the pain of soreness after, and “an *intense itching*,” and it commends itself to all cattle owners how far the above, varied by an occasional sharp pain, as if the maggot was “screwing itself round in the hole,” can benefit the infested animals.

The above communication is given at length, as, besides the information regarding pain and annoyance, it certainly is a confirmation of

* The sketch of the form of the maggots, taken together with the description sent, corresponded very exactly with the figure of the larva of one of the *Dermatobia*, of which the fly is unknown, given in ‘*Monographie der Cæstriden*,’ by Friedrich Brauer, plate x., fig. 3. The prolonged shape of the extremity into a tail-like appearance is very peculiar, and the creature appears to bear a strong resemblance to the well-known “Ver Macaque” of Cayenne.

the plan of treatment we are adopting in *choking the maggots*, to find that in regular medical practice, on the human subject, the application of some kind of treatment *simply to exclude air* is all that is necessary to kill these allied kinds of maggots in a few hours.

The matter of the intense itching is well worth consideration. From information from various quarters, and from what I have seen myself, the cattle appear to lick themselves as far as they can manage to reach when the warbles are appearing: if this is a constant habit in bad attack, it would be a guide to its presence, and an additional reason why the applications of grease mentioned in the following notes as a remedy should be useful, for it would at once sooth the pain, as well as kill the maggot.

Applications for destroying maggots in the warble, and for preventing or lessening amount of attack to the cattle in fly-time.

Observations have been sent in of the safe and successful use of mercurial ointment for killing the maggot in the warble from various cattle owners and others who have used it up to the amount of application to 250 head of cattle in a herd of 800. In these cases the ointment has been used as advised in previous publications, as *a small touch* on the opening of the warble; by *no means* as a large dab, *nor* as a smear, *nor* where warbles were gradually showing, as an application to be made repeatedly over a large surface of warbled hide. Only one instance in which bad consequences followed the application has been reported to me, of which it is unnecessary to repeat the account again here, the details, comments, and opinions thereon having been already given in the 'Agricultural Gazette' for 1885, Nos. 598, 599, and 601, and likewise in other leading agricultural journals of that date.

Used with caution the mercurial ointment has been found thoroughly serviceable, but, as a general application safe in all hands, McDougall's "Dip" or "Smear" has proved excellently useful. At my request Messrs. Carruthers and Co., Lancaster, forwarded tins of the "Dipping Smear" to various localities where the mixture could be tried by my own correspondents on their own herds, or the cattle under their care; and all the reports sent me have spoken quite satisfactorily of this mixture as a sure and safe method of killing the maggot in the warble.

The experiment of application of cart-grease is well worth observation, as this is a material which can be left standing anywhere about farm-buildings, always at hand, and very cheap, and it may be smeared in all directions by the most careless hands with little loss and no risk.

The mixture of sulphur with various applications, or its use merely as a dusting on the back of the cattle, is also noteworthy.

The use of lard or butter by the so-called "Charmers" in the wild districts of Co. Mayo is a great confirmation of how much may be done by the very simplest application which will choke the breathing-apparatus of the maggot. On hearing that cures were really made by these reputed "charmers," I wrote over to request an account of the *whole* of the ceremony, and, stripped of the incantations, the application is obviously so useful it is worth adding to the list.

The following notes refer to application of mercurial ointment.

"June 10th, 1885. Resulting from your advice, I have within two months dressed about 250 head of cattle out of 800 with mercurial ointment for warble maggots with speedy and complete success, and without any bad effect whatever. My herdsman all now swear by your remedy; but I think at a very early period in spring, dressing down the backbone with sulphur might be a great prevention also."—J. A. FARRELL, Esq., D. L. MOYNALTY, Kells, Co. Meath, Ireland.

"We put the mercurial ointment on to the swellings this year, and I was much pleased with the effect, as the cattle were certainly much smoother than last year."—Col. G. COUSSMAKER, Westwood, Guildford.

"I have used the mercurial ointment on several beasts, and in most instances the grub has been killed. I am going to dress again the lumps where there seems to be a grub alive."—Hon. CECIL PARKER, Eaton Estate Office, Eccleston, Chester.

"After reading Miss Ormerod's pamphlet on the subject, I sent for some mercurial ointment, both blue and yellow, and got the bailiff to apply it at once, as most of our cattle were infested with warbles. This he did by putting a small quantity sufficient to cover each hole, and slightly rubbing it in, and I believe in every case it had the desired effect. It either choked or poisoned the maggots, for on pressing the warbles a few days afterwards it was evident they were killed and decomposed, as nothing but a yellowish matter came from the sores. Both ointments appeared equally efficacious, and no harm resulted to the cattle from its use. I intend to renew the treatment next year."—T. A. SUTTON, Yew Tree Farm, Tarporley, Cheshire.

The two following observations refer to *McDougall's smear* as effective to kill the maggots, and as preferred to mercurial ointment or the application of salt and water:—

"The cattle that came under my own observation were successfully treated with mercurial ointment. The cases were about two hundred. Passing the hand over the sides of the *poorer ones* it was perceived that there were innumerable grubs in the skin, or possibly they were

under the skin. In about two weeks many of these put up swellings, in some cases double the first number. These were treated with McDougall's preparation—a pretty strong solution. A good many continued to put up at intervals of a few days, which were also treated with McDougall's preparation."

"Either of these remedies may be relied upon, but I think the solution is *quicker* in its action, the swelling subsiding—indeed, disappearing—after three days. I prefer the solution myself; it is so much easier of application."—RALPH LOWE, Sleaford, Lincolnshire.

"A lot of three-year-old heifers (black polls), which had not been housed last summer except in bad weather, were all affected. They have now calves at foot. The short-horn crosses used for the dairy, which had been kept in at night all the summer, were clear of warbles, except a three-year-old, which was always in the house at night. A year-old polled bull, just brought in, had many warbles. I desired the cattleman to dress one-half of the lumps with strong salt and water, the other half with McDougall's dip. A few days later I went out with mercurial ointment, which you recommend, to touch them myself. The salted ones were all lively, as I saw when I made the cattleman press some out, but the *McDougalled ones were all dead and flattened*. A few calves of last year had them, but the bulk had escaped."—W. E. CATTLEY, Edderton, Ross-shire, N.B.

The following notes refer to the successful use of *McDougall's preparations*, and also to the use of *sulphur* as a dusting, which likewise appears to have been very serviceable :—*

"Concerning warbles in cattle, I find that McDougall's Carbolic Sheep Dip, which is non-poisonous, kills the warble after it has made a small hole in the skin. I am now using train-oil, sulphur, and spirits of tar to keep the fly from attacking the cattle."—JOHN W. CROMPTON, Rivington, near Chorley, Lanc.

"I had each cow dusted along the back with sulphur. The result is that only two cows had one solitary deposit each; the others were perfectly free, whilst there are several on the backs of their calves.

* I have to express my thanks to Messrs. Carruthers and Co., Lancaster, for obligingly forwarding various 5 lb. tins of McDougall's Smear, price 3s. each, gratuitously to different correspondents of my own for trial, and I also give the following communication from Messrs. Carruthers relatively to some differences which they name in the effect of the "Dip" and the "Dipping Smear."—ED.

"In the 'Sheep Dip' it is objected that it hardens the skin, and does not for any considerable time prevent the fly striking or attacking the sheep or other animal to which it is applied. The 'Dipping Smear,' though containing the same active principle, keeps the skin in a beautifully soft condition, and, being of a sticky, greasy nature, holds the carbolic and other ingredients that are objectionable to the fly for a much longer time than the 'Sheep Dip' would do. It could be easily applied by being dissolved in boiling soft water, and then applied with a brush to the back or any other part likely to be attacked."

To those deposits I have used carbolic acid mixed with hog's lard, in the proportion of one to twenty, with excellent effect."—T. DUCKHAM, Baysham Court, Ross.

"I promised to write you again regarding dressing cattle against the Warble Fly. My experience at present is that they lie much quieter in the fields, and appear far more contented after being dressed than without. I dressed them with McDougall's Smear, and then powdered them over with flour of sulphur."—T. ROGERS, The Homme, Dilwyn, Leominster.

"I am glad to say that we found McDougall's Smear effectually killed the warble grubs. The mode of dressing we adopted was to shape a piece of wood or stick like a knife-blade with a point. We searched carefully for the warble-hole; then, with a plentiful dip of smear on the wooden blade, we put the point in the warble-hole, and gave it several turns in the hole, leaving a good portion of the smear on the warble; this appeared to completely choke up and kill the maggot. The mode of dressing to kill the warble was not painful to the cattle; those that were quiet appeared to like the friction, as I can believe the warble to give perpetual irritation. As a preventative from attack we rubbed a quantity of dry sulphur upon the back of our dairy cattle, from the shoulder to hip on each side of the spine, and a little on the brisket. We believe the sulphur had the desired effect, as our cattle were quiet in their pastures, while I could see some herds near were much tormented. The dressing was repeated frequently; the brisket was dressed to keep the gadfly away. We used sulphur as being free from smell, and not liable to taint the milk. . . . Our young cattle are much more troubled" [it was then purposed to dress them.—ED.]; "they stand in water the greater part of the hot days, with no trees to shade them. At times they set off full gallop to a shady place, stay for a time, and back again. . . . The calves (six months old) are more quiet; they have shady trees and a cool bank by water to lie upon. These, I have noticed, are not disturbed, while those twelve months older (named above) are much excited, and these not more than 200 yards distant from each other."—DAVID BYRD, Spurstow Hall, Tarporley, Cheshire.

The following notes give some further observations of success in the use of carbolic acid, and of mercurial ointment, for killing maggots in the warble; but more especially regard the good effect of greasy applications, easily procurable, such as cart-grease or lard, and rancid butter, especially when mixed with sulphur.

"I applied cart-grease to the backs of twelve cows. In two days after I examined the animals, and found all the warble-maggots dead. I have also tried six with cart-grease and sulphur. Both methods of

application were successful, but the grease mixed with sulphur did the best. The cart-grease was hog's lard of the roughest sort, without salt."—F. RAVENSCROFT, Calveley, Tarporley, Cheshire.*

"Have tried a number of experiments for the killing of the warble-maggot in the hide. I think the best application is mercurial ointment, as this seems to putrify the maggot, and healing takes place in about a week. . . . I also tried a remedy of my own, rancid butter and paraffin, well-mixed, and put on the warble; it answered very well."—A. C. C. MARTYN, Agricultural School, Aspatria.

"I have given a fair trial to the following methods of destroying the grub in the warble, when it is established and the orifice is open. My experiments began in March, and continued until the 1st May:—Carbolic acid (one part of acid to three of oil), paraffin, lard, and mercurial ointment. Of these remedies I consider the two former sure destroyers of warbles, and, if applied properly, not in any way dangerous. Paraffin especially, for, if licked off by an animal once, I have not known it to be a second time, but I am unable to say this of carbolic acid; but even this licking may be got over by giving the animal a handful of hay after applying the remedy. Lard acts as well as anything, if applied moderately early (say March 15th), but on using it later in the season I found it not to be so effective."—F. W. HORSFALL, Newland House, Leamington.

Mr. Horsfall suggests that the lesser effect of the lard, when applied late in the season, is from the tail-end of the maggot being nearer the opening of the warble, and the grease apt to run over instead of taking full effect within the opening.

During the past summer a communication was sent me by Mr. P. M'Hale Greer, Ballycastle, to the effect that in Co. Mayo, Ireland, when the cattle were severely affected by warbles, it was a common practice to take them to the "charmners," who in some way or other killed the maggots. Such being the result, I asked for the details of the incantation, as it was plain there must be some very sure and simple remedy at the bottom of the matter; and on investigation, which Mr. Greer was good enough to undertake for me, and which has since been confirmed as quite trustworthy, it turns out that the basis of the cure is butter or lard. Mr. Greer's report, given on next page, also shows the prevalence of attack in exposed situations.

* Under the superintendence of Mr. W. Bailey, Head Master of the Aldersey Grammar School, Bunbury, Tarporley, Cheshire, the attention of the pupils living in that essentially agricultural and dairy-farming district has been particularly directed to warble-attack, and large numbers of the maggots have been destroyed by them, up to 230 maggots being killed by one of the pupils. Besides cart-grease and cart-grease and sulphur, mentioned above, mercurial ointment and McDougall's Smear have been successfully applied.—ED.

“In this part of Ireland (West Connaught) farmers are completely in the dark as to treatment of parasites and grubs in stock and crops. When their cattle are seriously afflicted from warbles—although still believing that they are a sign of health in cattle—they run to the next “charm-maker,” of whom there are an abundance, and pay to the “charmers” treble the sum of money which, if expended upon medicine, would leave their stock hale and healthy.

“In the barren and bleak districts, exposed to the scorching rays of the sun, and without stream or pond, tree or shrub, to afford coolness or shade, the hardy mountain cattle suffer to an alarming extent from the ravages of the Warble Fly when laying its eggs. The tract of country through which some of these poor animals career is often surprising. It extends to miles, and eventually causes their owners no little trouble and expense to bring them back again. The injury done to the animals themselves from exhaustion during the summer and from irritation in the winter is so great that many a strong and healthy animal becomes languid, unable to eat, and unable consequently to thrive. These cattle have not been properly housed, and oftener than not half-fed, and the warble-maggot develops with extraordinary rapidity and to a large size. The larger the maggot grows the more pus it requires for its support, so that, what with insufficient food and the great annoyance caused, the cow becomes a fit subject for the “charmer” and her spells. She is generally an old woman, and the methods of procedure are very simple. When she enters the stable of the sick cow she calls for some butter or lard. After it has been placed before her she prays for a time to some spirit (that I wot not of, nor could I find out). After the spirit of destruction is exorcised she takes the butter and gently covers the breathing aperture of the maggot and crosses it. The result of all this is that the maggots die, and fall, or are easily picked out, without causing the least pain. I know not what good the incantations of the “charmer” may have exercised, but a little butter or lard, and I should say a small quantity of sulphur (I believe the “charmers” use sulphur) laid on as we have seen will leave a warbleless hide.”—P. M’HALE GREER, Ballycastle, Co. Mayo, Ireland.

Summer attack and means of prevention.

The point which it appears to me we have most to depend on for getting rid of this wasteful attack is knowledge of some dressing or wash which will prevent fly-attack and terror from the same in summer. Destroying the maggots in the warbles necessarily destroys one fly for each maggot, and where the maggots *are* destroyed there we find attack correspondingly lessened; but the business is *to get people to do this*.

There always will be an enormous percentage of those who will take no care about what is not very much troubling them at that instant, and so it is too often with regard to destroying the maggots; but every cattle owner or herdsman objects to seeing his cattle going full drive over the fields on a hot summer day, and therefore knowledge of simple applications which have been found to answer to prevent this, is a key to open to us the whole of the course of prevention.

Stopping the galloping is showing safety from fly—safety from fly is safety from maggot—safety from pain of the boil-swellings, inflammation, suction of the great grubs themselves, and the train of losses and inconveniences consequent thereon.

I wish particularly to draw attention to the three following observations on this matter, as being applications which have been well tried and found successful.

The first, it will be observed, reports the serviceableness of McDougall's Sheep Dip, and the benefit being clearly proved by the cattle, which had previously been troubled by warbles, "being almost free from them" in the following season.

"My cattle have been very much troubled with warbles. The summer before last, in the end of May, I dressed them with McDougall's Sheep Dip, repeating the dressing occasionally till the end of August. The result was most satisfactory, *as the next year they were almost free from them.* I shall in consequence always continue to dress them so."—JOHN M. MOUBRAY, Broom Court, Alcester.

The two following notes are repeated from last year's Report, being in each case from thoroughly qualified observers, and having been again tried and found successful in the past season by other observers:—

"I have used and also recommend the following mixtures as a preventive:—Flour of sulphur, 4 oz.; spirits of tar, 1 gill; train (whale) oil, 1 quart. Mix well together, and apply along the spine of the cow once a week with a small brush. The smell drives off the flies, and prevents them depositing their eggs, and the cattle are left *at peace* to graze, and warbles thus prevented."—HENRY THOMPSON, M.R.C.V.S., Aspatria.

"I venture to give my experience of many years. If cattle that are turned out into the fields (those that are in sheds escape entirely with me) are rubbed all down the spine with train-oil, and a little also on the loins and ribs, they will be free from this pest, have their hides uninjured, will do much better, and will graze quietly at the time that others not so treated are tearing about with their tails in the air.

"Two or three dressings I generally find enough, but much depends

on the season and the thickness of the 'coat.'—B. ST. JOHN ACKERS, Prinknash Park, Painswick.

It will be observed that after both the above applications the cattle are noted as *remaining at peace* in the pastures.

The following washes or dressings have been reported as having been found more especially useful amongst many tried by the experimenter :—

“ Sulphur, 1 lb.; soft-soap, 1 lb.; boiling water, 3 pints; to be applied about once to the back of the animal with a brush.

“ Sulphur, $\frac{1}{2}$ oz.; prepared lard, $1\frac{1}{2}$ oz.; tar, 1 oz.; one rubbing in will last well.

“ Carbolic acid and oil; one part of carbolic acid to fifty of oil.

“ Kerosine oil.

“ Oil of turpentine, 4 oz.; oil of tar, 4 oz.; linseed oil, 4 oz.; to be well rubbed in along the back.”—A. C. C. MARTYN, Agricultural School, Aspatria, Carlisle.

Sulphur and train-oil, and paraffin and oil, have been tried as preventives of egg-laying with good effect by F. W. HORSFALL, Newland House, Leamington.

The result of the foregoing observations and the various experiments agree with those of the previous season, and appear to be as follows :—first, with regard to warbles, that any application whatever that will choke the breathing-pores at the tip of the tail of the maggot, and can be laid for this purpose on the opening of the warble, will kill the maggot within, and the sooner this can be done the better for the animal that is infested.

In regard to preventing fly-attack, or the apparent sign of it, which is the mad gallop of the cattle in the summer, it appears by comparison of observations that train-oil, or mixtures in which oil forms a part, are the most useful. The obvious reasons for this are the deterrent smell and the unfit state of the hair for egg-deposit when soaked with grease; but it also seems to me open to consideration whether the application of the oil may not also soothe and do good by allaying the irritation and itching of warbles then present, though not known of.

It will be seen in the following tables that maggots are frequently present throughout the summer, and, though I only submit the view as a conjecture, it may be that the putrescent smell from these is an attraction, and that the good oilings at once stop irritation and overcome the attractive smell.

Particulars of Sound and Warbled Hides, sold at one of the three Birmingham markets, from beginning of the warbled season, viz.,
February 14th to the end,—September 19th,—1885.

	95 lbs. and upwards.	Price.	Total Sound.	Warbled.	Price.	85 to 94 lbs.	Price.	Total Sound.	Warbled.	Price.	75 to 84 lbs.	Price.	Total Sound.	Warbled.	Price.	65 to 74 lbs.	Price.	Total Sound.	Warbled.	Price.	55 lbs. and under.	Price.	Total Sound.	Warbled.	Price.	Heavy Cows.	Price.	Total Sound.	Warbled.	Price.	Light Cows.	Price.	Total Sound.	Warbled.	Price.	
Feb. 14	O 11	5				29	4				31	4				44	4				38	4				44	4				54	4				
	X 33	5	44	1	4	23	5	52	1	4	25	4	56	3	4	26	4	70	3	4	11	4	36	4	37	17	4	61	2	3	9	4	63	0		
" 21	O 15	5				9	4				19	4				46	4				37	4				38	3				41	4				
	X 15	5	30	1	4	17	5	26	2	4	24	4	43	5	4	19	4	65	18	4	10	4	47	16	4	25	4	63	2	3	43	4	47	3	3	
" 28	O 20	5				22	4				29	4				35	4				34	4				57	4				43	4				
	X 18	5	38	2	4	10	5	32	5	4	19	4	48	7	4	14	4	49	7	4	14	4	48	11	4	3	4	68	9	3	9	4	52	3	3	
March 7	O 23	5				16	4				22	4				36	4				32	4				47	3				49	4				
	X 9	5	32	4	4	11	5	27	10	4	19	5	41	7	4	16	4	52	26	4	9	4	41	9	4	5	4	56	5	3	44	4	55	7	3	
" 14	O 16	5				15	4				25	4				23	4				29	4				32	3				44	4				
	X 14	5	30	6	4	22	5	37	10	4	22	4	47	14	4	10	4	33	19	4	9	4	38	20	4	2	4	40	13	3	10	4	54	5	3	
" 21	O 9	5				21	4				15	4				20	4				15	4				16	4				40	4				
	X 12	5	21	3	4	7	5	28	11	4	15	4	30	19	4	20	4	40	23	4	15	4	30	23	4	5	4	36	5	3	40	4	44	6	3	
" 28	O 12	5				6	5				14	4				33	4				31	4				29	3				43	4				
	X 18	5	30	8	4	17	5	23	11	4	16	5	30	23	4	15	4	48	38	4	9	4	40	21	4	4	4	33	9	3	6	4	49	9	3	
April 4	O 14	5				20	5				26	4				30	4				29	4				35	3				28	4				
	X 10	5	24	6	4	7	5	27	16	4	16	4	42	37	4	10	4	40	43	4	8	4	37	32	4	2	4	44	15	3	5	4	33	9	3	
" 11	O 19	5				17	4				41	4				35	4				28	4				18	3				29	3				
	X 10	5	29	9	4	12	5	29	9	4	17	4	58	24	4	8	4	43	32	4	7	4	35	41	4	1	4	33	7	3	4	4	31	5	3	
" 18	O 16	5				18	5				33	4				30	4				23	4				14	4				32	4				
	X 8	5	24	11	4	12	5	30	13	4	13	5	46	24	4	10	4	40	35	4	5	4	28	38	4	3	4	43	17	19	3	24	4	34	10	3
" 25	O 12	5				16	5				26	4				29	4				23	4				6	4				20	4				
	X 11	5	23	1	5	13	5	29	9	4	6	5	32	22	4	9	4	38	42	4	3	4	26	24	4	3	4	28	4	3	0	4	34	12	3	
May 2	O 9	5				27	5				41	4				36	4				28	4				21	4				33	4				
	X 6	6	15	2	5	10	5	37	14	4	17	5	58	16	4	7	4	43	21	4	3	4	31	14	4	2	4	35	6	4	6	4	39	5	3	
" 9	O 15	5				28	5				42	4				47	4				31	4				13	4				33	4				
	X 5	5	21	4	5	6	5	34	7	4	14	4	56	14	4	6	4	53	16	4	4	4	35	13	4	0	4	42	10	3	5	4	44	5	3	
" 16	O 5	5				13	5				39	4				48	4				44	4				11	4				28	4				
	X 10	5	15	5	5	7	5	20	4	4	12	4	51	13	4	13	4	61	21	3	8	4	52	25	3	3	4	40	2	3	25	4	40	9	3	
" 23	O 5	5				23	4				36	4				14	4				40	4				15	4				31	4				
	X 9	5	14	3	4	17	5	40	2	4	13	4	49	15	4	14	4	53	12	3	5	4	45	23	3	2	4	37	8	3	6	4	31	3	3	
" 30	O 15	5				15	4				28	4				31	4				30	4				14	4				21	4				
	X 4	5	19	2	4	4	5	19	4	4	13	4	41	17	4	11	4	42	19	3	5	4	35	14	3	2	4	22	5	3	7	4	28	5	3	
June 6	O 6	5				6	4				31	4				15	4				33	4				23	4				25	4				
	X 3	5	12	0		8	5	14	2	4	15	4	46	10	4	8	4	45	20	3	4	4	37	29	3	1	4	20	1	3	4	4	29	6	3	
" 13	O 2	5				13	4				33	4				10	4				32	4				21	4				38	4				
	X 2	5	5	0		7	5	20	4	4	16	4	49	10	4	10	4	45	20	3	10	4	42	23	3	2	4	36	4	3	2	4	40	7	3	
" 20	O 2	5				8	4				30	4				19	4				38	4				29	4				27	4				
	X 2	5	4	0		6	5	14	1	4	23	4	49	9	4	10	4	38	17	3	9	4	47	19	3	1	4	30	10	3	4	4	31	5	3	
" 27	O 2	5				8	4				23	4				54	4				34	4				27	4				19	4				
	X 1	5	3	0		7	5	15	1	4	16	4	39	6	4	12	4	66	34	3	2	4	36	23	3	3	4	23	9	3	4	4	33	9	3	
July 4	O 8	5				11	5				18	4				15	4				53	4				34	4				22	4				
	X 4	5	12	0		15	5	26	0		25	4				17	4				6	4				2	4				3	4				
" 11	O 6	5				8	5				27	4				27	4				51	4				27	4				23	4				
	X 10	5	16	0		12	5	20	1	4	13	5	38	5	4	12	4	39	15	4	9	4	60	13	3	1	4	28	8	3	5	4	44	8	3	
" 18	O 6	5				9	5				25	4				42	4				37	4				38	4				23	4				
	X 5	5	11	0		12	5	21	0		26	5	51	1	4	20	4				9	4				5	4				9	4				
" 25	O 5	5				8	5				20	4				29	4				38	4				30	3				24	4				
	X 6	5	11	0		12	5	20	0		20	5	40	0		16	4				8	4				6	4				6	4				
Aug. 1	O 1	5				9	5				23	4				32	4				64	4				25	4				16	3				
	X 15	5	16	0		16	5	25	1	4	44	4				22	4				22	4				3	4				5	4				
" 8	O 7	5				11	5				44	4				51	4				55	4				23	4				23	3				
	X 2	5	9	0		21	5	32	0		17	4	61	0		22	4				2	4				2	4				8	4				
" 15	O 2	5				12	5				29	4				55	4				60	4				29	3				28	3				
	X 14	5	16	0		22	5	34	0		27	4				30	4				62	4				33	3				30	3				
" 22	O 4	5				17	4				18	4				13	4				18	4				5	4				9	4				
	X 6	5	17	0		17	4				38	4				65	4				61	4				33	3				44	4				
" 29	O 15	5				14	5	31	0		21	4				30	4				17	4				5	4				4	4				
Sept. 5	X 7	5	21	0		21	4				37	4				59	4				90	4				27	3				24	3				
	O 13	5				23																														

Particulars of injury and difference in price per pound of sound and warbled hides of different classes.

I am favoured by Messrs. Fry and Company, Leather and Hide Factors, Birmingham, with the particulars given on the accompanying tables (overleaf) of the numbers of sound and warbled hides at one of the three Birmingham markets, and the price each parcel sold at from the beginning of the warbled season, *viz.*, Feb. 14th to the end, Sept. 19th, 1885.

These details, it will be seen, extend over a duration of thirty-two weeks, and include price per pound of “ordinary” and “extra flayed” hide (marked down the third column as “o” and “x” respectively), as well as of those which are warbled.

By casting the eye along the columns it will be seen that the first three heavy classes, namely, those of 95 lbs. and upwards, 85 to 94 lbs., and 75 to 84 lbs., which are all or nearly all ox-hides, do not suffer as much as the three following. These last—that is, the classes weighing 65 to 74 lbs., 56 to 64 lbs., and 55 lbs. and under, are principally heifer hides, and are the greatest sufferers. Bulls’ hides are stated, as a rule, to be also very much warbled, but as these are not what is termed “thrown out,” but sold (sound and warbled) together, the proportion of warbled hide could not be given.

The following abstract of the larger tables is given for convenience of reference. The amount sold during the thirty-two weeks of sound and of warbled hides may thus be conveniently compared, together with the highest and lowest prices per pound of each. The sound hides include both the ordinary and the extra flayed.

Abstract of table overleaf, with particulars of different classes of hides sold during warbled season of thirty-two weeks from February 14th to September 19th, 1885.

Weight and description of classes of Hides.	No. of Sound Hides.	Highest and lowest prices per lb.	No. of Warbled Hides.	Highest and lowest prices per lb.
95 lbs. and upwards...	621	5d. to 6d.	68	4½d. to 5¼d.
85 lbs. to 94 lbs.	911	4¾d. to 5¾d.	138	4¾d. to 4¾d.
75 lbs. to 84 lbs.	1495	4½d. to 5¾d.	306	4d. to 4¾d.
65 lbs. to 74 lbs.	1789	4d. to 4¾d.	541	3½d. to 4½d.
56 lbs. to 64 lbs.	1692	3¾d. to 4¾d.	497	3½d. to 4½d.
55 lbs. and under.....	873	3¾d. to 4¾d.	305	3½d. to 4½d.
Heavy cow-hides	1193	3¾d. to 4¾d.	140	3½d. to 4d.
Light cow-hides	1382	3¾d. to 4¾d.	151	3½d. to 3¾d.
	9956		2146	

I have been also favoured with the information that the selection for warbles commenced in the previous year (1884) on February 14th,

and finished on October 4th, *viz.*, thirty-four weeks, or two weeks longer than last year; and it was also considered that the proportion of warbled hides to sound was greater in that year (1884) than in the last season (1885). The attack on the heavier classes also stopped in the same ratio then as last year.

To give some idea of the amount of loss represented, it may be noted that a deduction of $\frac{3}{4}$ per lb. on a hide of 95 lbs. weight means a loss of 6s. 3d. on the hide, and this is simply waste money; it does not represent profitable outlay of any sort, merely shows a loss on the health of the beast beforehand, and loss and inconvenience to the buyers and users of the leather afterwards.

Careful study of the detailed tables is well worth while for those practically interested. They show the different time over which attack extends from the 14th of February, and that it certainly cannot be considered as stopping in July. We find it in the three lighter classes of hides as still present on the 19th of September, but it is worth some notice that three heavy classes did not contain warbled hides at a much earlier date. The heaviest ox-hides, 95 lbs. and upwards, were free after the 30th of May, and the two others of these heavy classes were free (save two hides in one class and one in the other) respectively after the 27th of June and the 18th of July.

It may also be seen that sometimes at what may be called the height of the warbled season, the number of warbled hides exceeds that of the sound in some of the classes. On the 25th of April entries occur amongst the "65 to 74 lbs." and the "55 lbs. and under" hides respectively of sales of 42 warbled to 38 sound, and 25 warbled to 9 sound.

PART II.—OBSERVATIONS ON THE DEVELOPMENT OF THE OX WARBLE AND WARBLE-MAGGOT.

The following notes are a digest of observations taken by myself from examination of pieces of hide so freshly removed from the cattle as to give the opportunity of watching the habits of the maggots whilst still either in their natural surroundings, or in live and healthy state, and are reprinted by permission from the original paper published in the 'Journal of the Royal Agricultural Society,' vol. xxi., part ii., 1885. The figures 1 to 15 were drawn (for accompanying illustration) from life or from dissections made by myself:—*

"The following observations on the Ox Warble-maggot are an

* I have to express my thanks to various correspondents for specimens kindly sent me, but especially to Messrs. Hatton, of Hereford, and Mr. J. Dalton, of Wigton, for pieces cut from fresh hides; and to Mr. Bazeley (butcher), Spring Grove, near Isleworth, for accommodation in examining infested hide immediately after removal from the animal.

endeavour to describe the changes, both in external form and internal structure, which it passes through so rapidly (from the time it is first noticeable in the opening warble until it gains the shape in which it is best known), that little notice appears as yet to have been taken of the details.



FIG. 1.

Fig. 1.—Channel through hide, much magnified.

The commencement of the attack* had been noticed in the previous November in the form of small inflamed patches or swellings on the flesh-side of the hide, within which the maggot lay free—that is, not enclosed in a cell—and down to which swellings a fine channel passed from the upper surface of the hide.

This channel appeared to have no lining membrane, but to be merely a passage gnawed or torn by the mouth-hooks of the maggot, and (as in fig. 1) sometimes slanting, or taking a straight course, or so *completely curved* at the upper part of its course that it was impossible that the channel where this curve existed could have been formed by the ovipositor of the fly; consequently, as the method of egg-laying may be presumed not to vary, to all appearance *proving* that the egg from which the maggot hatched was laid either outside or just beneath the outer cuticle of the hide.

Careful watch was kept both on living cattle and newly-flayed hides in various localities throughout the winter, in order to secure the date of the first appearance of the warble in its open condition, which took place (generally) from about the 14th to the 25th of February. The first advance on the condition of a mere hair-like streak through the hide was found in specimens cut from the hide of a young bull, and sent me by Mr. John Dalton, of Wigton, on Jan. 27th. In these there was the first appearance of the warble as a *perforated swelling*, with the maggot of a clearly distinguishable size within. The channel through the hide was still very small, the opening on the outside being about as large as the prick of a common darning-needle, and below, though larger, scarcely the sixteenth of an inch across.

This perforation, or maggot-gallery, was somewhat cone-shaped, with *smooth, white, shiny walls*. These conditions are important to be

* This is described in my 'Eighth Report on Injurious Insects,' p. 115.

observed, as they show that the passage could not be formed by ulceration, which would not have given clean smooth walls to the hole.

The maggots in this state of warble differed in size; the smallest I measured was about half an inch long, and nearly worm-like in shape; rounded at the mouth-end, bluntly pointed at the tail, white, transparent, and marked across what may be called its back with



FIG. 2.



FIG. 3.



Fig. 2.—Young maggots, much magnified. Fig. 3.—Mouth-forks of very young maggot, much magnified.

sixteen short bands of very minute black or dark grey prickles, placed, for the most part, in alternate very narrow and broader stripes. There was some variety in the shape of the maggots, according to whether they were alive and distended with fluid, or other circumstances; but those I had at this stage were worm-like or spindle-shaped, and in the youngest condition the maggot was furnished with a pair of strong mouth-forks (fig. 3), which are a most important item in its structure, and, as far as I am aware, have not previously been noticed in the young maggot of this species of *Hypoderma* or Warble Fly.

The apparatus may be described as consisting of a pair of crescent-shaped forks, placed nearly side by side, at the extremity of processes somewhat bent apart at the ends by which they are attached to the crescents, and attached by the other ends to the membranes or tissues forming the gullet or internal sac of the maggot (see fig. 3, showing, at 1 and 3, the crescent-shaped forks in slightly different positions, and at 2, the apparatus viewed sideways, so as to show the curved ends of the processes). The material is chitinous or horny, and the colour yellowish brown, and, though excessively minute, the hook forms a very serviceable cutting or dragging implement.

The possession of this apparatus by the maggot in this early stage is a great confirmation of the belief that the creature gets down to the subcutaneous tissues of the hide simply by cutting its way forward. We appear here to have both cause and effect, for we find as a regular thing that there is a minute track down to the embryo warble beneath the hide, which said track has the appearance of having been cut or gnawed; and in the exceedingly young and still worm-shaped

maggot found on Jan. 27th there was the apparatus for cutting or gnawing.

The duration of special habits of life in the maggot may be divided into three periods: that above mentioned, when its chief work appears to be making its way down; the next, when it starts into the active state which *precedes* its first obvious appearance in the opening warble, and in which its most important work is forcing its way up again, tail foremost; and the third, in which, having formed the opening, it lies within feeding, mouth-end downwards, in the filthy discharge its own presence causes, until it is ready to leave the hide, and turn to the chrysalis-state.

The method by which the perforation is effected has given rise to much ingenious speculation; but, by carefully watching the habits of the young living maggots, and likewise the condition of the perforation in fresh hide during the very short time which is occupied by the first formation of the perforated swelling known as the warble, the whole process appears clearly traceable.

The tip of the tail of the maggot, which is of necessity the point of the wedge that precedes its owner up the hide, is *not* now ended, as in its latest state, by two flat, kidney-shaped spiracles (fig. 4); whilst the boring work has to be done, the spiracles are of a different form. They are, during this time, somewhat club-shaped, or, when highly magnified, appear like short bent cylinders (fig. 7, overleaf). These are of horny or chitinous materials, and each of the pair of spiracles, or breathing-pores, is placed at the extremity of a large

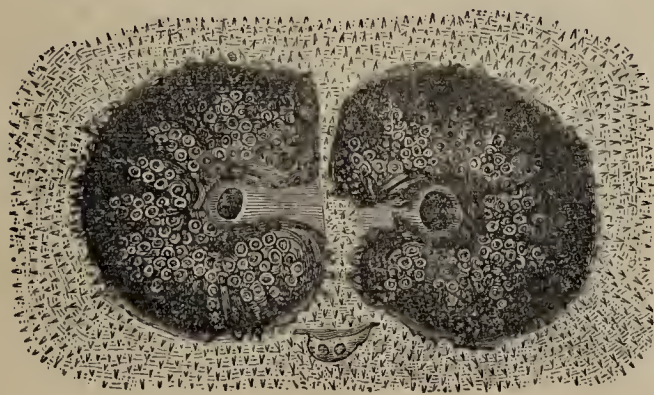


FIG. 4.

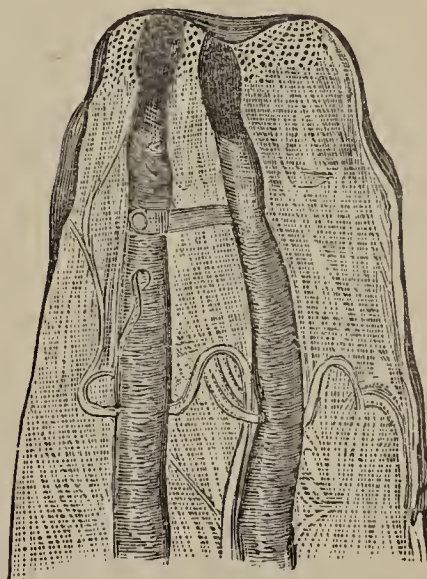


FIG. 5.

Fig. 4.—Latest form of spiracles, much magnified. Fig. 5.—Spiracles and tracheæ of young maggot, much magnified.

trachea or breathing-tube, which pair of tracheæ are tied together by a transverse tube placed near the spiracles. The maggot is thus provided (fig. 5) with a compact, hard-tipped apparatus, very suitable,

with due pressure from behind, to force open and gradually enlarge the fine passage (see fig. 1) leading down in the early stage of attack, from the outside of the hide to the embryo swelling beneath.

The power of pressure possessed by the maggots at this period of their life is enormous, from their capacity of inflating themselves with fluid until they are so hard that it is scarcely possible to compress them with the fingers, and likewise from their having (apparently) no power of discharging any of their contents. Thus they form living and growing plugs, quite capable of pressing back the tissues from around them, or from before the small hard tip; but *not* subject (so long as they continue inflated) to being themselves compressed. I had opportunities of watching this process of inflation both in the worm-shaped maggots and when they were slightly more advanced in growth to a club or lengthened pear-shape. On placing them in fluid suitable for absorption (as in glycerine and water, in which they would live for as long as eighty hours, or until the spiracles sank completely beneath the surface) they became hard and shiny, and with little trace of the segments which are so clearly marked when the maggots are fully developed; in fact, they were almost of a glassy smoothness, save for the short bands of minute prickles placed along a portion of the back.

The size and shape of the perforation through the hide altered progressively with the growth of the maggot. At first this passage was very little larger at the lower than at the upper opening; and, though the walls of the perforation had now become smooth and shiny, I could not distinguish the presence of any distinct lining membrane. With the enlargement of the passage its shape became more cone-like (corresponding with the altering form of its tenant); and, on March 5th, I found for the first time a distinct pellicle or skin-like membrane covering the walls of the perforation, or passage, and continuous with the lining of the maggot-cell below. The amount of development of the warbles at a given date varied very much; warbles just beginning to form might be found together with those nearly three-quarters of an inch across, as measured on the flesh-side of fresh hide on the 4th of March, but, when once started in growth, the progress was excessively rapid, and those who wish to watch the progress of the first stages have need to be on the alert.

The great change, both in the appearance and the internal structure of the maggot, took place when it was grown to about a third of its full size, when it assumed its well-known shape. Previously to this, whilst the work of forming its passage was still in progress, its chief characteristics externally were the absence of everything that could obstruct its power of pressing onwards; and internally it was little

more than a bag of fluid, with a large proportion of the space *occupied by breathing-tubes*,—a very important consideration relatively to available methods of destroying the creature. At the period, however, of its moult to its final stage a change takes place respectively in the nature, or in the amount, of development of nearly the whole of both the internal and external structure of the maggot. The hard tips necessary, or at least serviceable, for forcing a passage up the hide, are no longer needed, and they are exchanged for a broad form of spiracle (fig. 4), and the internal organs become suited to provide material for the development of the fly, which will presently form in the dry husk of the maggot which serves as the chrysalis-case.

One of the first and most remarkable of these changes is the complete alteration in the form of the spiracles. Up to this stage the general form continued (see fig. 5) to be that of a pair of short horny, somewhat bent cylindrical, or partially cylindrical, tubes, covered at the end (fig. 7) with round or oval discs, which appear to have a definite narrow border, and across the centre of the disc to be of a sieve-like or spotted appearance. Fig. 8 precisely represents the appearance when much magnified. These discs may amount to as many as about six-and-twenty on each spiracle, and appear to me to be placed each at the extremity of short cylinders. The structure is most elaborate and peculiar, and the only somewhat similar instance of this development in any maggot that I am aware of having been observed, is in the structure of the cephalic spiracles of the larva of



FIG. 6.



FIG. 7.

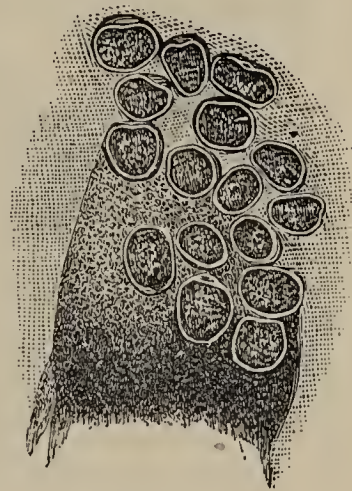


FIG. 8.

Fig. 6.—Full-grown maggot, under side, much magnified. Fig. 7.—Spiracle-tube (one of the pair), much magnified. Fig. 8.—Discs at extremity of spiracle, as seen with $\frac{1}{4}$ -in. object-glass.

the *Trypeta pomonella*, Walsh, described by Professor H. Comstock in the Report of the Department of Agriculture U.S.A. for 1882, p. 197. There it is noted that each of the spiracles he describes “is expanded into a plate, the free margin of which is fringed by a double

series of cylindrical projections about twenty in number. With a very high power of the microscope the distal end of each of these projections appears to be sieve-like, an arrangement which, doubtless, prevents the entrance of any foreign matter into the respiratory system." Whether in the case of the warble-maggot the spotted or sieve-like appearance is given by microscopic hairs placed to preserve the entrance free, or by other structures, I could not ascertain on account of the excessive minuteness of the organs; but a fringe of this nature is to be found in some forms of spiracle, and the use of such an apparatus to guard the entrance of breathing-tubes, when acting in a passage which is being formed in living hide, is obvious.

Up to the time when the moult takes place to the final form of which I am now speaking, these spiracles are buried up to their discovered tips in the tail-end of the maggot; but then they are cast off entirely with the moulted skin, and in the newly-exposed skin beneath we find the first appearance of spiracles of the well-known kidney shape, but with the surface more radiated, and of a paler chestnut-colour than in their later condition.

During the spring investigations I had an opportunity more than once of observing, and also securing, both the moulted skin containing the early form of spiracle, and likewise the proprietor maggot, bearing the new kidney-shaped pair; and also, in one instance, secured the



FIG. 9.



FIG. 10.

Fig. 9.—Early form of spiracle, with fragment of moulted skin, still attached to kidney-form shape, much magnified. Fig. 10.—Fig. 9 in different position, showing breathing-pores.

maggot when about to moult off the old skin, and thus was enabled to secure the specimen whilst still bearing the rejected early form of spiracles in the old skin, with their lower ends still attached to the new kidney-shaped pair now formed at the tail of the maggot.

Figs. 9 and 10 show the old club-shaped form, resting on the kidney-shaped form, which, after this change, lasts, with some slight modification, through the rest of the life of the maggot.

The newly-formed spiracle, having had a portion of its thickness removed so as to show it as a transparent object, will be observed to be furnished at the upper surface with numerous cylindrical pores or openings, corresponding in appearance with those represented magnified at fig. 8. These are the terminations of cylindrical passages which are connected lower down, and which appear, as far as the thickness of the chitinous material allows them to be traced, to be ramifications of a small number of upright passages opening from the great trachea below, and passing upward through the spiracle, thus giving communication with the outer air by means of the cylindrical branchlets with their open extremities.

The internal apparatus of the spiracles and the attached breathing-tubes underwent a corresponding change at the time of this moult. Fig. 11 gives an inside view of the base of the newly-formed spiracles with apertures in the centre, leading into the old pair above them.

The parallel lines round a portion of the circumference of the fluted saucer-like discs, and the raised portion round the central perforation, show where a small portion of the old and new air-tubes (tracheæ), belonging to the old and new spiracles, were cut through in making the transverse section.

These air-tubes, like the spiracles at their extremities, were now, at this portion of the maggot, in duplicate. This in itself is not remarkable, but it is not often that the moult of the tracheæ can be so perfectly observed. A reference to fig. 5 will show the general appearance of the tracheæ of the maggot, with the *cross trachea* that



FIG. 11.



FIG. 12.

Fig. 11.—Bases of pair of old and new spiracles (viewed vertically), much magnified. Fig. 12.—Section of tracheæ, much magnified.

joins the two main tubes; and, on making a section across at this point, the old air-tube with its branch was clearly to be seen, lying detached in the corresponding part of the new tube.

The cross section shown at fig. 12 shows the newly-formed tracheæ with the connecting tunnel, and within one of the tubes is a section of the smaller old trachea, now floated loose in the balsam in which

it is preserved, but which, when freshly cut, had its main side-branch down the side-branch of the larger tube.

These special observations on the moult of the breathing-apparatus may very possibly not bear practically on the subject of the prevention of warble injury; but they are of interest to show how minutely we are acquainted with the history of this maggot, the ravages of which are, in many cases to this day, left unchecked, as being a pest of unknown nature, and of which therefore the cure is unknown; and, further, the specimens give an unusually detailed example of the completeness of this internal moult. The sections having been taken so as to remove respectively some small fragments, both of the brown and the white structure at the junction of the spiracles with the tracheæ, they may be accurately fitted together again, and thus form a whole, showing the old spiracle still bearing the old skin round its top raised on the new form, likewise surrounded by the new skin; and beneath we have the corresponding old and new air-tubes.

Other alterations of a very practical kind also take place at this time, or follow on this most important of the moults. The skin of the maggot becomes furnished within with a powerful coat of muscles, extending over it like basket-work. A maggot at this stage, besides the power of contraction and expansion, which may be observed in protruding and withdrawing the mouth-end with the regularity of pulsation, has a power of dragging itself along at a rate of three times its own length in two minutes, and has a very definite method of progression. The mouth-end is somewhat raised, and the creature

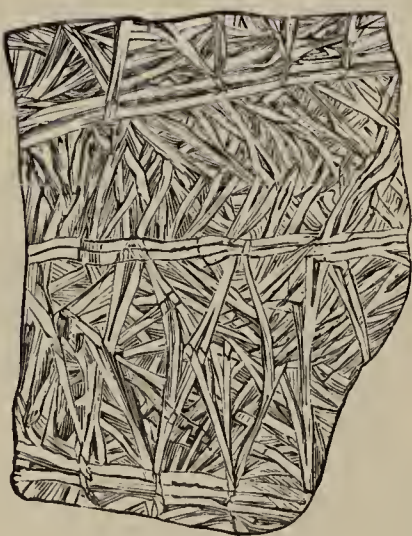


FIG. 13.

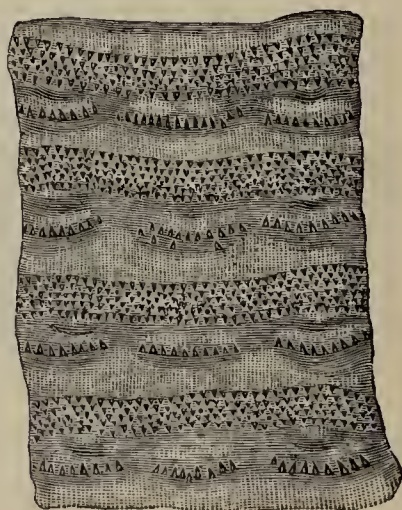


FIG. 14.

Fig. 13.—Muscles within skin of maggot, magnified. Fig. 14.—Prickles of maggots, much magnified.

appears to move with as settled a purpose in any given direction as other grubs or caterpillars. Externally, in this stage the skin of the maggot is furnished with a much larger amount of prickles, arranged

in more numerous bands, than are noticeable in the previous stages. The prickles are now strong enough to cause an unpleasant sensation when the maggot crosses the hand, and to play an important part in its locomotive powers in its cell, and in the effect on the tissues caused thereby. The visceral contents are now thick, and obviously formed of the filthy matter which is caused by the perpetual irritation of the suction of the mouth-end of the maggot at the bottom of the sac. It is also now furnished with a small curved caudal aperture, placed nearly between the spiracles (see fig. 4), from which some slight amount of discharge of contents can take place.

These are the main differences connected with the moult to the final form of the maggot, and, following on these alterations in its structure, and especially on the power of keeping up a constant irritation by means of the muscular expansion and contraction of its prickly skin, we find the lining membrane of the cell increasing in thickness, until it becomes well defined as a tough wall round the perforation, continuous with the upper part of the cell. Fig. 15 shows a cell drawn in section, and slightly magnified after maceration in water. The lowest end of the maggot-chamber appears full of foul matter, caused by the irritation of the friction and suction of the maggot; and, after the creature has crawled from its hole, a pressure on the empty warble is followed by a discharge of some amount of purulent matter.

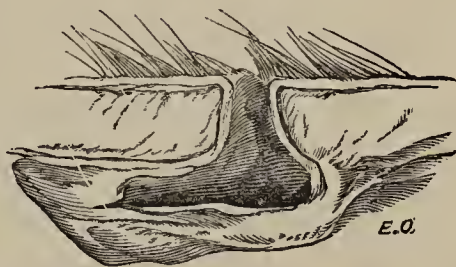


Fig. 15.—Warble-cell, slightly larger than life.

When the maggot has gained the condition mentioned above it undergoes no further great change until it turns to the chrysalis-state. The spiracles become less radiated and darker, the maggot also becomes darker as it increases in size; but the main points of its life now are to form, at the expense of the animal in which it lives, the material from which the fly will presently be developed, to start (unless means have been taken to prevent it) the next season's attack on the herd."*

When the warble-maggot is about to change to the chrysalis-state, it squeezes itself out, tail-end foremost, from the warble, and, after falling to the ground, creeps to some shelter where it turns to chrysalis, from which in due time the fly comes out. These changes have previously been described, but the following notes, by Mr. A. C. C. Martyn, Agricultural School, Aspatria, add some useful information from personal observation, as confirming previous statements that the

* "Observations on the development of Ox Warble and Warble Maggot," by Eleanor A. Ormerod, 'Journal of the Royal Agricultural Society,' vol. xxi., part ii., 1885.

maggots leave the cattle between evening and morning, and likewise regarding the effect of cold in lengthening the time before the fly leaves its chrysalis-case ; also his method of rearing the fly for examination is of interest practically, as in this way all so disposed may secure specimens, and be able to recognise this insect-pest when on the wing amongst the herd.

In regard to the time at which the full-grown maggot squeezes itself out of the warble, Mr. Martyn found this always took place in the morning, or at some time between six o'clock in the evening to about eight o'clock the next day. To secure the warble-maggots, when fully-developed, he fixed a little muslin bag over one or two warbles, and in this way prevented the maggots dropping to the ground ; but, as there were difficulties in managing this method, he tried putting a ring of bird-lime round the hole, and found the maggots fixed in this in the morning, but never in the middle of the day.

The chrysalis-stage he found lasted about twenty-five days, as noted with eighteen specimens, but to see how far heat or cold caused a difference in the duration of this state, Mr. Martyn put four chrysalids by themselves, and kept the temperature they were in much lower. These developed to flies in an average of thirty-six days,—that is, over ten days later than the others. The flies were not so fine or well-marked, nor were they quite so large as the others.

The fly is figured at commencement of this paper : in the case of five of the twenty-five reared by Mr. Martyn, the portion of the abdomen beyond the transverse black band was grey instead of yellow or orange. This point is worth observation, as there may be some variety of the fly at present undescribed.

We now, I believe, only need observations of the exact position where the egg is laid to complete the life-history of the Warble Fly. Any observations, and especially all information practically bearing on checking fly-attack in summer, will be very acceptable for future publication, and, with another season's observations added to those already contributed, it may fairly be hoped that we may then have sufficient well-proved information to afford material for a special publication, fully illustrated, of the complete history of the Warble Fly, and method of treatment successful in checking its increase and ravages. Meanwhile, it would give me much pleasure to forward any information in my power, or, if wished, a copy of these " Observations " to any who will communicate with me.

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